SEPTEMBER 1959

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

FIFTH ANNUAL STATISTICAL REPORT

What the next decade holds for the electrical construction industry as indicated by recent patterns in the economic environment and the current up-swing in construction activity.

A special report.

A McGRAW-HILL PUBLICATION

58TH YEAR

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BETTER WORKING ATMOSPHERE
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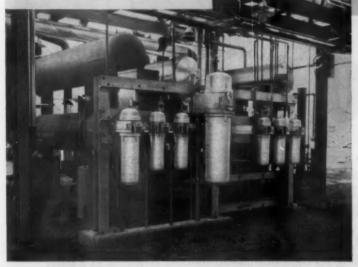
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ELECTRICAL CONSTRUCTION AND MAINTENANCE

SEPTEMBER

1959 continued

Grits blast booth for small motors; electric soldering gun promotes shop efficiency; drum controller cuts multi-voltage test time.

Product news announcements; catalogs and bulletins.

Questions and answers on pulley centers; flywheel design; threaded EMT.

Answers to code questions on four-wire delta service; seating capacity of a building; motor controllers and disconnects; branch circuit overcurrent devices; electrical space heating.

In the News 209

Vol. 58, No. 9

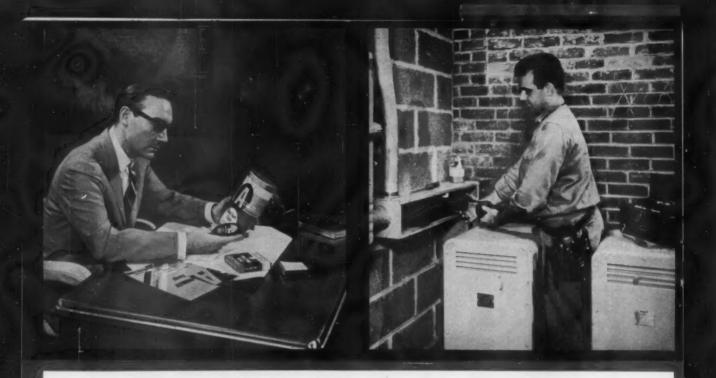
ELECTRICAL CONSTRUCTION and MAINTENANCE

SEPTEMBER 1959

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high tensile strength
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ACCURATE MANUFACTURING COMPANY Garlield, New Jersey The national economy should stabilize at a high level following settlement of the steel strike. This opinion is reflected, in part, by Administration plans for a bigger 1960-61 Federal budget, despite all of President Eisenhower's economy efforts. It now aims for a Federal spending range of \$80 to \$82 billion, which it is expected would provide a surplus of \$1 to \$2.5 billion, as revenues continue to increase. Current estimates of spending in fiscal 1959-60 are for a total of \$78.5 to \$79 billion, compared with President Eisenhower's original \$77-billion budget.

National economy growth is being studied by two separate top-level committees, and their findings will be much in the news over the next few months. The Committee on Price Stability for Economic Growth, a Cabinet committee under the direction of Vice President Nixon, was set up by President Eisenhower with the primary objective of educating the public on the dangers of inflation. A special task force composed of economists and professional scholars, has also been appointed to the Joint Economic Committee to make a searching analysis of growth-inflation problems, and recommend governmental action, for use by the Congress.

New construction spending in July rose to a record \$5.2 billion. Private construction totaled \$3.6 billion, while public construction outlays totaled \$1.6 billion, each up about \$100 million from June totals. Construction volume for the first 7 months of 1959 is 15% above the total for the similar period of 1958.

Home building declined slightly in July, when housing starts dropped to 126,000 from the June total of 136,000 units. Total private home starts for the first 7 months of 1959 were 822,000, highest total for this period since 1950, the record home building year, when the 7-month-period record was 836,000 starts.

The Federal highway construction program, being financed by a special highway trust fund, faces a deficit in this fiscal (1959-60) year, and an even bigger deficit in the years ahead, based on the existing pay-as-you-go plan, unless some way is found to provide additional revenue. The outcome will be a slowing down of the program, or the creation of additional financing.

Cost-of-Living inched higher in July when the Government's consumer price index rose 0.3% to a record 124.9% of the 1947-49 average. About one million workers will get a two-cents-an-hour increase in pay, as a result, through escalator clause contracts.

James A. Brandt has been named Advisor to the Director, Electrical Equipment Division, Business and Defense Services Administration, U. S. Dept. of Commerce. Mr. Brandt, an official of Reliance Electric and Engineering Co., Cleveland, will serve on a temporary Government assignment basis, without compensation, which is usually for a six-month period.

The national economy keeps rolling along in spite of the steel strike, although Washington officials begin to worry over the effect if the strike runs much beyond 90 days. Gross national product hit a record \$484.5 billion annual rate in the 2nd quarter, \$14.3 billion above the 1st quarter rate; Industrial output in July fell two points from June to 153% of the 1947-49 average; Employment at mid-July was at a record 67,954,000, while unemployment dropped 238,000 from June to 3,744,000.

Sidelights

GIGANTIC PROMOTION

A huge 30-page insert in *Life Magazine* is carrying the story of the Medallion Home this month to millions of consumers. A part of the Live Better Electrically program, the advertising job is believed to be the largest single project of its kind ever attempted by any industry. The impact should be enormous. Electrical contractors who want to tie in with the program should contact their local electrical league, wiring bureau, or power company sales department. If no local Medallion Home program is underway contact the National Wiring Bureau for information on promotion and sales aids which you can use.

LOOKING AHEAD

There is little doubt now that this threshold year should sum up new records for electrical construction business volume. Barring a disastrous reaction to the steel strike we ought to hit the new decade at a good clip with a highly favorable economic climate for the years ahead. Our statistical summary which leads off the feature section takes a forward look at the 60's and what they hold in potential for the industry. Backing our optimism for the future are five impressive current developments—the new lighting levels, the universal application of air conditioning, the beginning of wide application of electrical heat, the automation of industry and the rapid mechanization of commercial methods. All are completely dependent upon electrical installation of greater capacity and complexity. We are clearly on the threshold of developments in electrical systems beyond anything we have seen before.

THE NEW CODE

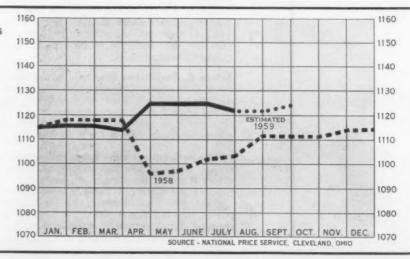
The 1959 revision of the National Electrical Code, expected to be distributed beginning this month, contains many significant changes affecting design and installation requirements for electrical systems. Associate Editor J. F. McPartland has compiled a special report spotlighting the major changes and explaining their significance. See "1959 National Electrical Code" beginning on page 87. Copies of the new revision will be available from your local inspection authority, the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass., or may be obtained from the National Board of Fire Underwriters, 85 John St., New York 38, N. Y.

SELLING COST-PLUS

How electrical contractors can sell desirable cost-plus contracts by demonstrating how they can produce quality installations at reasonable cost. Ray Ashley, nationally known authority on electrical estimating, emphasizes the selling points in his article "Selling a Cost-Plus Contract" beginning on page 98.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



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New 3000 Series NuTone Hood·Fans

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BASIC NUTONE HOODS CAN BE "TAILOR-MADE" INTO

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SELECT ANY HOOD SIZE... ANY HOOD FINISH... ANY POWER UNIT

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PREWIRED AT FACTORY... TO SAVE VALUABLE INSTALLATION TIME

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4 EASY WAYS TO INSTALL NuTone's 3000 Series Hood Fans!



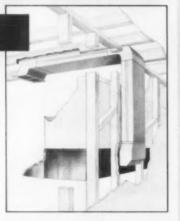
Here's the newest idea in Hood-Fans... that saves you money when you buy... and saves you money when you install. Get COMPLETE FLEXIBILITY... Choose the exact Hood-Fan you want and the type of installation best suited for your needs!

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NuIone

1. Vertical

Transition elbow in wall and ducts concealed between the wall studs.



2. Horizontal

Ideal for outside wall. Horizontal discharge through outside wall cap.

3. In Cabinet

For installation along the back wall of cabinet and soffit above.

See other side



4. In Wall

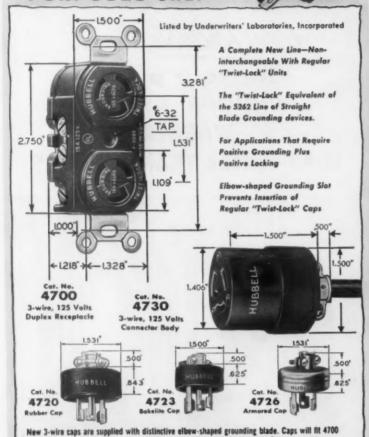
For a wall fan installed below the hood on an outside wall.



The First and Only Twist-Lock

GROUNDING
PURPOSES ONLY

Cort. No.
4720
3-wire 15 ampt.,
125V Rubber Cap



engineering news

HARVEY HUBBELL, INCORPORATED
Engineering Department

WHY A 4700 LINE?

Ever since the advent of National Electrical Code requirements for the





10 amp., 250 volt 15 amp., 125 volt IEMA Grounding Type 15 amp., 125 volt

125 volt level, a definite need has existed for a locking receptacle meeting these requirements.

ing these requirements.

To answer that need Harvey Hubbell, inc. has developed a new "Twist-Lock" receptacle that meets all of the code requirements and those of Underwriters' Laboratories, Inc. for 125 volt grounding as well as provide a vibration-proof locking connection.

The 4700 line, as is the well known N.E.M.A. standard grounding receptacle, is equipped with a ground connection terminal beragonal in shape.



New 4700 Type 15 amp., 125 volt

Elbow-shaped Grounding Slot

preen in color and electrically connected to the mounting strap or yoke. It provides, too, split circuit convenience, removable washer type plaster cars, pressure plate back wiring, all completely enclosed in a husky molded phenolic casing.

phenolic casing.

The Hubbell 4700 receptacles, caps and connectors are non-interchangeable with any "Twist-Lock" presently in use. There can be no conflict of ratings or electrical service. The 4700 has only one rating: 15 amp. 125 volt A.C. It cannot be mis-applied electrically, as its sole function is to provide for equipment ground connections on single phase, 125 volt circuits—exactly the same job as the N.E.M.A. grounding receptacle performs with the additional all-important feature of providing a LOCKING connection that cannot accidentally disconnection that cannot accidentally disconnection that interrupt power service.

HARVEY HUBBELL, INCORPORATED

BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

Series connector bodies or receptacles only. They cannot be used with regular Twist-Lock devices.

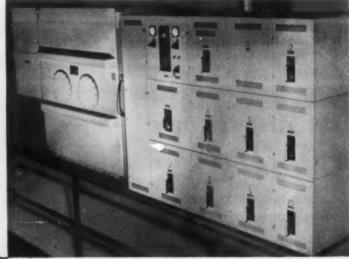
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IN CANADA: Scarborough, Ontario, 1160 Birchmount Road

Continued on page 68

Wadner SEALED DRY-TYPE TRANSFORMERS

These modern unit substation transformers can be safely installed in any load-center—any place—because they are hermetically sealed in welded steel cases to provide positive protection from contamination, fire and explosion hazards. The only maintenance needed is periodic checking of gas pressure (inert nitrogen), case and bushings.



Here's Reliable Power

for your plant
electrical system
WAGNER
LOAD-CENTER TRANSFORMERS



National INDOOR DRY-TYPE TRANSFORMERS

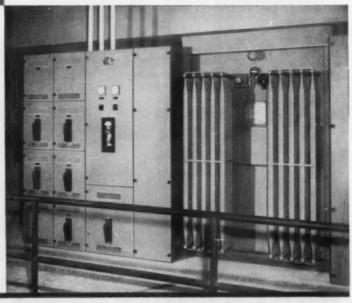
These new quiet-type transformers are compact, light in weight, provide a flexible, modern power system to change higher voltage distribution service to lower voltage lighting and power circuits. They meet all safety requirements for indoor installation.



NOFLAMOL TRANSFORMERS

Non-inflammable liquid filled. For indoor or outdoor installation. Close-coupled design fits flush against switchgear enclosures, to eliminate and save space. Throat-connected designs are also available.

Bulletins TU-205 and TU-214 give full information on Wagner Load-Center Transformers. Write today.



WT59-

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SERVING 2 GREAT GROWTH INDUSTRIES ... ELECTRICAL ... AUTOMOTIVE

CRESCENT

PORTABLE POWER CARLE

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For supplying power to electric shovels, dredges, etc.

Shielded to assure protession to personnel and equipment

Provided or a pense like been spered in the development of CRESCENT IMPERIAL NEOPRINE PORTABLE CABLES. They assure long dependable service under the most severe operating conductivity, high to the strongth flexibility, dependable conductivity, high to the strongth. They are non-kinking and have unexcelled religiones to water, abrasion, revenue and combined from recovering which is formulated and processed to an in provide maximum verticinine to oil, graphs, strong are excessive heat. Florid, most acide and allegies.

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CRESCENT INSULATED WIRE & CABLE CO., INC.

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For Institutions

For Stores



FASHION PLATE, exciting new way to turn lights on . . . off. The only true decorator switch that's rugged enough for commercial and industrial use.

NEW TAP-ACTION FLUSH SWITCH FROM BRYANT

... FOR HOSPITALS, DEPARTMENT STORES, MOTELS, OFFICES, FACTORIES, HOTELS, RETAIL SHOPS, APARTMENT HOUSES . . . FOR EVERY COMMERCIAL OR INSTITUTIONAL JOB YOU WIRE

Tap-eez is the exciting new companion switch to Fashion Plate.* Its appearance is modern ... the new, slim, tap-action bar blends well with design. More important, the attractive flush mounting makes it easy to clean ... perfect for commercial applications where the

emphasis is on economic maintenance. Tap-eez has positive action, low maintenance and whisper quiet operation . . . no teasing . . . no arcing. Its service is more reliable than ordinary toggle switches . . . really built to *last!*

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Smooth quiet action. Bar moves only 3/2" to operate mechanism.

UNLIMITED APPLICATION—AVAILABLE IN SINGLE, DOUBLE AND TRIPLE GANG PLATES—IN BROWN, IVORY AND STAINLESS STEEL COMBINATIONS



Long-life silver alloy contacts. Positive controlled contact action. Rugged construction for heavy use.



Fits standard switch boxes, requires no special wiring. Compact design.



Easy, fast installation. Time-saving, clamp-type back wiring.

TAP·EEZ

The exciting things come from



THE BRYANT ELECTRIC COMPANY BRIDGEPORT 2, CONNECTICUT

*Trade-Mark

J-99017-R

When "GOOD ENOUGH" isn't enough use triangle control cable

Failure in a control cable is a messy business. The fault is hard to find, and operations must stop until it is found. That's why contractors and engineers don't use just a "good enough" cable is those vital links—they want the best. Many now guarantee this by specifying and using Triangle Control Cable.

But, there is no such thing as one all-purpose control cable construction. That's why Triangle makes these five general types—each designed for a particular set of circumstances:

- 1. Rubber insulated, braid covered
- 2. Rubber insulated, Trioprene sheath
- 3. Rubber insulated, lead sheath
- 4. Trioseal insulated, Trioseal sheath
- 5. Triolene insulated, Trioseal sheath

These are available in conductor sizes 14 to 9 with 1 to 37 conductors. Special types to meet unusual conditions are made to specifications. Types of control cable are available for aerial, conduit, tray, underground duct and direct burial installations.

Informative technical literature is yours for the asking.
Write for your copy of our Control Cable Bulletin.



SAFE and SURE... a SLIPKNOT SPLICE





Always fresh, exceeding all ASTM electrical specifications. Slipknot has been the standard of the industry for more than half a century. Extra adhesive strength assures best work, even on rough and irregular surfaces. Non-raveling, never dries out . . . results of rigid quality control and tremendous volume.

The quality tapes of





The only commercial rubber tape with the U.L. Label, PR Splicing Compound fuses instantly, conforms without voids to any irregular shape, and will not dry out. Complete electrical protection—perfect companion to Slipknot Friction Tape.

the experienced electrician

Inseparable fusion of adhesive to vinyl base means easier, swifter, surer, more permanent splicing than ever before! Slipknot Plastic Tape has wider temperature working range — no creeping or thinning — abrasion resistance — resists water acids, alkalies, cils, corrosion. Molds totally around any shape. No. 7 (.007" thick) has minimum dielectric strength of 10,000 volts.

The 66-foot roll, in individual can, comes with FREE exclusive Slipknot Cutter. (patented)





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MASSACHUSETTS

How to determine proper Control Run for Remote Control Switches

With remote control switches (as with any electromagnetically operated device), it is absolutely essential that maximum allowable run for each switch should not be exceeded.

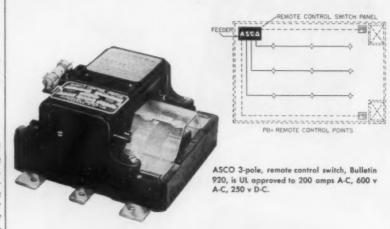
Here is a handy guide to help you determine admissible distances between switch and remotely located control station:

- Doubling the control voltage will increase the allowable run with the same size of wire by about 4 times.
- 2. Doubling the cross sectional area of the control conductors will increase the allowable control run by 2 times. The cross sectional area of a conductor will approximately double with three gauge number sizes larger wire. Thus #14 has approximately double the area of #17, and onehalf the resistance per unit length.
- Full consideration should be given to the use of auxiliary relay control for remote control switches, particularly for group installations requiring master control and for extremely long runs.

The following tabular data specify maximum distance between control station and one Bulletin 920 switch with source line voltage at 90% of normal. Similar charts are available on the range of ASCO "remotes."

	865	DISTANCE	IN FEET
AMPERES	GAUGE	110 V. 60 CYS.	220 V. 60 CYS.*
30,60,75	14	550	1600
	12	900	2600
	10	1400	4200
100,150,200	14	325	1200
	12	500	1900
	10	800	3000

*For 208 volt system, reduce 220 volt values by 30%.



Why Mechanically Held

A remote control switch is essentially a feeder disconnect switch. Consequently, it is usually installed in a lighting or power distribution panel feeding numerous circuits. In function the disconnect switch used should operate just like the manually operated type of disconnect switch—it should be unaffected by line voltage conditions and should respond only to the control of the push buttons.

Only a mechanically held switch can meet these requirements. Mag-

netically held contactors, which open on momentary line voltage dips and control circuit derangements, introduce the hazard of complete outage on vital circuits until repairs can be made.

ASCO Mechanically Held Remote Control Switches are unaffected by line voltage conditions; each switch includes a manual operating knob or handle so that the switches can be operated manually at any time.

The values for control run listed are for one switch. For installations involving more than one remote control switch connected to the same control conductors, the values listed can be considered as switch-feet. The allowable run for group installations will be equal to the listed values divided by the number of remote control switches operating from the same control conductors. Thus, if one switch has an allowable run of 100

feet with #14 wire, ten switches will be limited to 10 feet. When switches are located along a transmission control line, calculations in terms of switch-feet will produce the solution.

Dependable control by ASCO

New catalog 57-S2 on ASCO Remote Control Switches is now available. Write today for this basic reference on dependable electromagnetic control.



Automatic Switch Co.

50-J Hanover Road, Florham Park, New Jersey
FRontier 7-4600







to YOU

ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

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The same goes for supply and service. Circle users know that nearby completely stocked warehouses can usually take care of their needs. And when they can't, they know a simple telephone call by their distributor to the plant will get the fast action they want.

So why don't you make a Circle distributor your "one sure source of supply"—many other satisfied customers do.



WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

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SAVE TIME—SAVE COSTS!
SPEEDOMATIC'S WONDER HANGER!

new

Smitheraft SPEEDOMATIC TROFFERS

evedi

New Smithcraft Speedomatic troffers are packed with features that save hours and dollars for you! Wonder hangers and double-fast screws. Installs in seconds from below with screwdriver. Built-in dimensioning gauge. Telescopic door frame assures perfect fit, even in irregular ceiling openings. Large wiring access door.

Only 415/16" deep, plenty of room for utilities.
Large wireway end openings. Safety-locking door frame hinges. Four basic types fit over 100 ceiling systems. Packed two to a carton, with or without door frame installed. Compare the contractor-minded Smithcraft Speedomatic and see for yourself why Speedomatic is today's fastest-installing troffer.

Smitheraft LIGHTING

Write today for a complete 30-page Speedomatic catalog and price list.

FREEI The Smithcraft Lightester measures your customers' and prospects' lighting in minutes. A valuable sales aid for youl Send for a free sample now.



+ Light-conditioning by Smitherate - America's finest fluorescent lighting

Uncompromised

flexibility begins with an empty box

> ...and a "Stab-in" idea



FEDERAL PACIFIC'S NEW TYPE SF FUSIBLE LOAD CENTER LINE—has no fixed circuits ... 10 standard enclosures take the place of 208 separate devices... meet all requirements from 30 through 200 amp main disconnects.

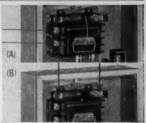
FLEXIBILITY THROUGH STANDARD STAB-IN UNITS

-all 5 are designed on a $1\frac{1}{2}$ " module, can be stabbed into simplified bus in any combination, in any position.



ADDED FLEXIBILITY THROUGH DUAL-RATING -ail enclosures are U.L. ap-

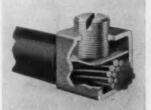
—all enclosures are U.L. approved for use as either service equipment(A) or as load centers(B).





PLUS THE FLEXIBILITY OF FLUSH/SURFACE FEATURE

—each Type SF enclosure can be either flush or surface mounted.



MORE FLEXIBILITY THROUGH COPPER/ALUMINUM LUGS

 U.L. approved. Lets you take advantage of low-cost aluminum conductors.

Now contractors can meet all day-to-day requirements with a small investment in 10 flexible enclosures, buying stab-in units as needed. Both are readily available from distributors stock. Write for bulletin 1-215A, Federal Pacific Electric Company, General Offices: Dept. 361, Newark 1, New Jersey.



FEDERAL PACIFIC ELECTRIC COMPANY

The Best in Electrical Distribution and Control Equipment

OFFSETS MADE WITH ONE

New Greenlee Multipurpose Bender

exclusive new design for bending ½"-2" steel and aluminum conduit and pipe

No. 888
Multipurpose
Hydraulic Bender
(Shown with No. 798
AC-PO Pump)

ask your distributor for a demonstration now,

or write for Bulletin E-234. Greenlee Tool Co., 1869 Columbia Ave., Rockford, Illinois

IN SECONDS! SETTING, ONE SHOT!

revolutionizes on-the-job bending



OFFSETS automatically made in seconds with one setting, one shot.



90° BENDS close to the end, with one shot in about a minute.



180° BENDS a simple two-stage operation with GREENLEE No. 888.

ONLY THE GREENLEE NO. 888
GIVES YOU THESE
OUTSTANDING ADVANTAGES...

- One-shot offsets always in correct alignment...no dog-legs.
- 90° bends in one shot, close to the end of pipe.
- Easy-to-read ram stroke scale... makes duplicate bends.
- Portable...easy to set up... simple to operate.
- Hand or power-pump operated.
- Bending shoes of high-strength aluminum alloy.

This is the bender you've been waiting for! Fast ... extra versatile for on-the-job or shop bending. Makes accurate offsets, 90° and 180° bends in ½" to 2" steel and aluminum conduit and pipe. Put it to work on your jobs now for faster installations, bigger job profit. Ask for a demonstration.

GREENLEE

GREENLEE TOOL CO.

1869 Columbia Ave., Rockford, Illinois



Sports lighting requires a combination of short-range and long-range floodlights to provide good visibility for participants and spectators, and to add dramatic effect. Economical Revere Eliptor floodlights on

Revere hinged poles illuminate this race track. Revere "2000" Series long-range, rear-serviced floodlights are mounted on the grandstand roof to increase intensity of illumination at the finish line.

Solve any outdoor lighting problem with Revere's complete, matched line

Peak lighting efficiency for any outdoor lighting application calls for a number of components, each designed to do a specific part of the job. Solving outdoor lighting problems is much easier when you install Revere equipment because—

1. Revere offers the widest line, making it easy for you to select the exact combination of components to solve *any* outdoor lighting problem. Everything you need from one reliable source simplifies ordering, assures on-schedule delivery of all components.

 Revere offers matched components . . . structurally matched for strength, balance, and perfect fit; design matched for peak lighting efficiency and best appearance.

3. Revere offers easier installation—lights, poles and accessories are made for each other. Installation is fast, easy, trouble-free.

Write for Revere's catalog of outdoor lighting equipment. You can solve any outdoor lighting problem with this complete, matched line

Revere components used to light race track





OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NI les 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario



"that fit always!"

Nobody knows better than you do how much time, trouble and expense are involved when electrical fittings don't fit properly. That's why Gedney has adopted the simplest of mottoes: Gedney Fittings fit. And we mean it!

Gedney Fittings are machined with unfailing accuracy, then carefully finished, finally they're scrupulously inspected. Result? You no longer have to make allowances for the fittings (and time) you used to throw away! One more thing. These better fittings cost you no more!

Think of all the places you can save time and money with these five new Gedney Fittings and Accessories!

DEDNEY INSULATED MALLEAGLE

(cadmium - plated). Polyethylene collar is free to turn while bushing is tightened...prevents binding, twisting, during installation. Sizes ½"

GEONEY JUMPER WIRE BONDING PUSHING. Solderless lug. Malleable

IRON GROUND BUSHINGS

(cadmium plated). Si derless lug. Free-turi ing polyethiyene colle prevents binding (wisting, of conducers. Sizes 1/4.

> GEDNEY PUSH-PULL TAB CAP. or plugging bushings, etc. Use again and again. Strong poly-

GEONEY STATIC PREVENTIVE GROUND CLAMPS.

Made to ground pipe or conduit from ½" to 8".



GEDNEY FITTINGS FIT

GEDNEY

ELECTRIC COMPANY



RKO BLDG. • RADIO CITY • NEW YORK 20 Foundry, Factory and Shipping Point: Terryville, Conn.





Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- . Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the **difference** in electrical cable?

New Uss Tiger Brand Amerbestos—Type IPE withstands both high temperature and moisture

Type IPE stands for Irradiated Polyethylene. By combining IPE insulation with asbestos in our new Tiger Brand Amerbestos Cables, we get excellent resistance to both high temperature and moisture.

Conventional asbestos-varnished cambric cables were good for high operating temperatures but had little resistance to *moisture*.

The new irradiated polyethylene-asbestos cable, Type IPE, is superior in every way to conventional AVA cable and it costs you no more. You get the same physical dimensions, finished appearance, and safe operating temperatures.

Subjecting the polyethylene to a high voltage electron beam causes it to lose its thermoplastic nature, thus permitting its operation at much higher temperatures. Polyethylene so treated is known as "irradiated polyethylene" and the process has

proved highly successful in severe field applications.

The big difference is that you can now use the cable for many more applications such as outdoor crane wiring, forced draft fan motors for boilers and other locations requiring high resistance to both heat and moisture. For more information, write American Steel & Wire, Dept. 9208, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand and Amerbestos are registered trademarks



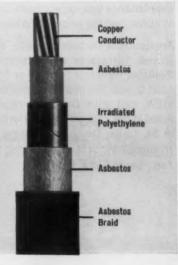
American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors United States Steel Export Company, Distributors Abroad

Test results show superiority of Amerbestos Type IPE Cable

Three 5-foot samples each of Type IPE and Type AVA Cable were wound around a mandrel 8 times the diameter of the cable and then straightened. This was done on samples after heating 48 hours at 130°C. Samples were then immersed in water at 50°C for one week. Insulation resistance readings were taken during this immersion and directly before breakdown. The IPE polyethylene insulated cables retained their high insulation resistance averaging 333,000 megohms against 36.9 megohms for the varnished cambric AVA cables.

Dielectric Strength average: Polyethylene 31.2 KV, varnished cambric AVA 7.06 KV.



THIS IS THE FAIRVIEW

New 8-foot lighting value by Day-Brite.

With one-piece, metal-framed enclosure of X-5 plastic.

Exclusive CLEARTEX® panel for low brightness.

Upswept sides for soft gradation of light on ceiling.

Separable hinges for one-man servicing.

Clean, crisp design complements any interior.

FAIRVIEW offers all the visual comfort, quality features, and ease of installation and maintenance you expect from Day-Brite... at about half the price you'd expect to pay!

Applications include schools, offices and stores. Surface or suspension mounting. Available for 8-foot Slimline or 4-foot Rapid-Start lamps. For more information on FAIR-VIEW, call your Day-Brite representative listed in the Yellow Pages. Or write Day-Brite in St. Louis. Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.; 530 Martin Ave., Santa Clara, Calif.







Builder Michael Campanelli (above, left) discusses telephone planning with Architectural Consultant Edward Poskus. In photo at right, Mr. Poskus tours a Campanelli model home with New England Telephone and Telegraph Company man "Pete" Danforth.

"People want telephone-planned homes"

-SAYS MASSACHUSETTS BUILDER MICHAEL CAMPANELLI

"We make pre-wired telephone outlets a standard feature of all the homes we build," says Michael Campanelli, Senior Vice-President of Campanelli Bros., Inc., Braintree, Massachusetts.

This progressive New England firm has built over 8000 homes in the past 10 years—and, since pre-wiring facilities became available, 3000 of them have been telephone planned. Every one of the Campanelli homes now under construction north and west of Boston contains pre-wired telephone outlets.

"People want telephone-planned homes," says Mr. Campanelli, "They like being able to add

extension phones easily when they're needed. And they like having the wiring for them neatly concealed within the walls.

"No question about it. Telephone planning is a plus feature that really helps us sell our homes."

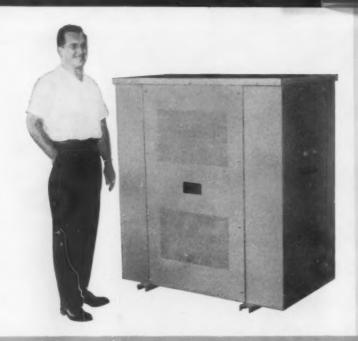
Your local Telephone Business Office will be glad to help you with telephone planning for your homes. For complete details on home telephone installations, see Sweet's Light Construction File, 8i/Be. For facts about commercial installations, Sweet's Architectural File, 32a/Be.

"The Regent," a modern Campanelli home in Danvers, Massachusetts.



BELL TELEPHONE SYSTEM





150 kva to 500 kva

(1) Single and three phase, 4800 volts and less, (2) Class B insulation, ventilated, (3) Floor mounted, cabinet type construction, (4) Large access panels on front and back, removable cover.

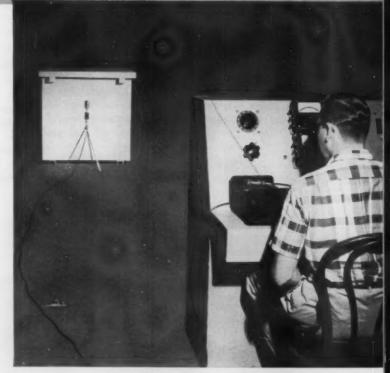
for GREATER OVERLOAD CAPACITY

DRY TYPE DISTRIBUTION TRANSFORMERS



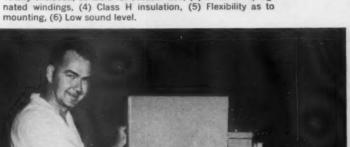
3 kva-1121/2 kva (TYPE DB & DBT)

(1) Silicone-impregnated windings, (2) Class B insulation, (3) Ceiling, wall or floor mounting, (4) Metal and porcelain terminal boards, see above, (5) High voltage and low voltage separated on voltages over 600, (6) Low sound level performance.



Sound Level Testing, Above

15 kva—112½ kva (TYPE DH & DHT)—(1) Accessible terminals and taps, in separate junction box, (see below), (2) Totally-enclosed, suitable for outdoor use, (3) Silicone-impregnated windings, (4) Class H insulation, (5) Flexibility as to mounting, (6) Low sound level.



3 kVa—10 kVa (TYPE H)—(1) Underwriters approved, (2) Compact, wall-mounted, (3) Silicone-impregnated, (4) Class H insulation, (5) Totally-enclosed, dust-tight, (6) Accessible clamp-type terminals as seen below.



... and consistently high level performance IN 4 MODERN MODELS... WITH ADVANCED DESIGN FEATURES

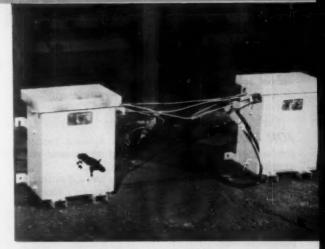
Research and product development pay off in transformers with greater overload capacity, longer life and quality performance. The improved quality of Uptegraff's line of dry type distribution transformers is the result of many years of research, persistent search for new and better materials, and engineering of the numerous design improvements listed on these pages.

Silicone-impregnated windings in all Class B types, 112½ kva and smaller, for example, provide greater overload capacity, superior moisture resistance and high temperature characteristics. Acoustical redesigning achieved quieter transformer operation. Among the many "quality control" tests is sound level analysis, seen on the left. Other tests—in addition to ASA, NEMA, and AIEE standards—assure transformers of optimum quality and performance.

Ask for New Bulletin

Complete product specifications of the four major models, ranging from 3 kva to 500 kva, 4800 volts and less, are given in Bulletin 137-A.





Silicone-impregnated windings withstand 42% more overload. Comparative insulation tests in Uptegraff laboratories showed that transformers with silicone-impregnated windings, above right, withstood up to 42% greater overload than ordinary varnish insulation, above left. Varnish failed at 210% of rated load, silicone impregnation withstood 300% of load.

R. E. UPTEGRAFF MANUFACTURING COMPANY

SCOTTDALE, PENNSYLVANIA

RECESSED TROFFERS BY SYLVANIA

...designed for the man who works with lighting!



Sylvania's new line of Recessed Troffers has received exceptional acceptance from men who know and work with lighting . . . and for good reasons.

These Troffers give the smart trim appearance and good lighting qualities that guarantee user satisfaction. In addition, they have important built-in features which are not apparent to this user—but which are vital to the designer and contractor responsible for the specification and installation of the lighting equipment.

FOR THE DESIGNER—Shallow Sylvania Troffers combine smooth, uncluttered finished appearance with practically limitless application possibilities.

The use of hidden latches and hinges and the extensive choice of shielding media bring the designer's ideas to attractive reality in the finished installation.

3 types of fixture housing—with exposed, concealed or fit-in flanges—permit Sylvania Troffers to fit ALL popular ceilings.

And Sylvania Troffers achieve any desired lighting layout because of the wide choice of standard elements including 1' and 2' wide models, downlighting Accent Units and 4' x 4' units.

GO MODERN WITH LIGHTING BY

FOR THE ELECTRICAL CONTRACTOR

Sylvania Troffers supply labor saving, time saving advantages so necessary for profitable operation. For instance—Sylvania's exclusive Snap-Up Hanger eliminates the need of hanger straps for many ceiling types and reduces installation time appreciably . . . and the adjusting screw of this Snap-Up Hanger levels the Troffer simply and quickly through the use of a screwdriver from below.

Wasted time and motion on the job are eliminated through Sylvania's use of maximum factory pre-assembly and unit packing. Fixtures are normally shipped in individual cartons with end caps and accessories in place and with shield frame and shielding installed.

The next time you specify or install recessed lighting, check the many advantages of Sylvania Troffers before making your choice. Compare Sylvania Troffers feature for feature with other makes. Then you be the judge.

For complete information, write to:

SYLVANIA LIGHTING PRODUCTS

A Division of Sylvania Electric Products Inc.
Department S-59-10

One 48th Street, Wheeling, West Virginia



Subsidiary of GENERAL TELEPHONE & ELECTRONICS



FLUORESCENT LIGHTING FIXTURES AND SYSTEMS . BEST FIXTURE VALUE IN EVERY PRICE RANGE



BEFORE YOU BUY RIGID GALVANIZED CONDUIT

Hand run a coupling on Steelduct uniform galvanized threads. The coupling will run free but not loose. Steelduct galvanized threads are sharp and clean because the Steelduct galvanizing process produces a measured uniform coating, free of any excess deposits of zinc. Uniform galvanized threads by STEELDUCT cut installation costs by eliminating rusty threads and assuring free running couplings.



THE STEELDUCT COMPANY

REPUBLIC STEEL BUILDING

YOUNGSTOWN, OHIO

McGILL° Levolier°

electrical specialties are

BUILT BETTER ** LAST LONGER



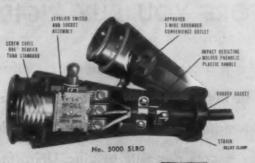
McGILL LEVOLIER SWITCHES

The same high standards of material selection and workmanship that make it possible for McGill to guarantee the No. 41 Levolier switch are applied to all McGill products. Levolier universal lever, toggle, momentary contact and special use switches from 3 to 20 amps have set performance records in a wide variety of uses. All are Underwriters' Laboratories, Inc. inspected.

MEGILL PORTABLE LAMP GUARDS



McGill Lampguards are designed and built to withstand rugged industrial service. Top quality and careful workmanship assures a safe dependable light; where you want it, when you need it. Over 100 different types available including Grounded, Vapor Proof, and a variety of types of cages, handles and sizes.



WRITE FOR McGILL ELECTRICAL SPECIALTIES CATALOG NO. 84



engineered electrical products



McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIV., 450 N. CAMPBELL ST., VALPARAISO, INDIANA

MURRAY INTRODUCES...

THE FIRST 200 AMP CIRCUIT BREAKER DESIGNED FOR RESIDENTIAL USE

now, for the first time, a fully magnetic 200 Amp breaker main disconnect in a full line of "MP" load centers far smaller than comparably rated main pullout equipment—



See reverse side for details

Available in a full line of load centers



Amazingly Compact Breaker Main Makes Possible First Really Small, Economical 200 Amp Load Center

At least 31% SMALLER...



than 200 Amp Load Centers with fusible mains

Competitive **Eusible Main** Load Center

Competitive **Fusible Main** Load Center

Competitive **Fusible Main** Load Center

Competitive **Fusible Main** Load Center







106%



163% Smaller

MURRAY 200 AMP CIRCUIT BREAKER



- · compact frame size
- · low price
- · ideal for residential use

plus...fully magnetic operation ... no thermal element!

The new Murray 200 Amp breaker contains all the important advantages of fully magnetic operation. It carries full rated load and is entirely unaffected by heat. Check these other features:

- · Tungsten silver contacts
- · Only two switch positions
- · Resets immediately
- Also available in 125, 150, 175 Amp trip ratings

Now, for the first time anywhere, contractors can give residential customers who need 200 Amp capacity true circuit breaker protection -right from the main disconnect down through all the branches. And do it at a surprisingly reasonable cost, too.

The new Murray 200 Amp breaker is so compact for its rating, it permits load centers far smaller than comparably rated fused main pullout equipment. (See above)

These load centers contain all of Murray's new design features for easier, faster, more economical installations:

Neutrals on top near main breaker: conveniently located in center of distribution area, saves cable and installation time.

Connectors for copper or aluminum: lay-in type connectors with pressure plates are U.L. approved for use with either copper or aluminum conductors-

Plaster line adjustments: separate dead front shield simplifies plaster line adjustments-

Shallow box construction: depth of load centers has been reduced to 3136", ideal for dry wall construction. This plus redesigned cover swell assures perfect flush mounting.

Other features include sequence bussing and truly generous wiring room despite small outside dimensions. If your homeowner customers have 200 Amp requirements, this new line is just what you need.

See it soon at your Murray wholesaler's-or write direct for complete details. Murray Manufacturing Corp., 1250 Atlantic Avenue, Brooklyn 16, New York.



LOAD CENTERS MAIN DISCONNECT ENCLOSURES Max. No. Positions Catalog Nos. Breakers Installed Cat. No. 1 Pole 2 Pole Raintight e Indoor* LC220DS LD200AS LD200R 2 Pole 200 Amp. LC224DS 24 12 LD000AS LDOOOR None† LC230DS 30 14 LC240DS 20 40

*Indoor. For flush mounting substitute suffix "F" for "S". With doors and provision for locks.

Main Breakers in above devices are rated 120/240V AC; also available in 125, 150 and 175 ampere trip ratings.

*Indoor. For flush mounting substitute suffix "F" for "S"

 Interchangeable hubs for raintight devices should be ordered separately. †Enclosures only, no breakers installed-order separately.

Diamond has all

portable cords



Red-D-Prene®

Neoprene Sheathed



for hot, olly locations

Black Diamond

Rubber Sheathed



for general purpose use

Signal Yellow



for all locations where heat is no problem



Red-D-Prene for mill and plant use is designed with tough, oil, heat and flame resistant Type MD (Mill Duty) neoprene jacket in industrial red for ready identification.



Black Diamond has durable rubber jacket protecting against alkalies, acids and moisture. Very flexible construction prevents kinking in service.



Signal Yellow has a jacket of yellow thermoplastic that is quickly seen ... clean to handle . . . smooth sheath will not readily collect dirt. Easy to pull.



DTX® Non-Metallic White Sheathed Cable

Type SE Service Entrance Cable mored & unarmored)

DUF® Type UF



and CABLE Company

Sycamore, Illinois

WAREHOUSE: BIRMINGHAM, ALABAMA

CHROMALOX Electric Heating Equipment

supplies the electrical answer for every heating problem to temperatures of 1200°F. The world's largest stock, over 15,000 standard items, is ready for immediate shipment.

In most cases, Chromalox heating equip-

ment can be applied using prepared calculation data. A nationwide network of Chromalox Sales-Engineering Representatives is ready to help you with those applications requiring special engineering and manufacture.

OVER-THE-SIDE IMMERSION HEATERS

For electroplating tanks, water solutions, alkali cleaning tanks, mineral oil, vegetable oil, wax or paraffin, fuel oil preheating, solvent vapor cleaning tanks.

CIRCULATION HEATERS

For accurately controlled heating of water, oils, heat transfer media, steam, air or other gases, heating rinse water, steam accumulators, process kettles, showers and washrooms, preheating fuel oil.



THERMWIRE HEATING CABLE AND TAPE

For heating pipes, valves and containers to prevent freezing. Roof eaves and gutters, concrete slab floors, asphalt and concrete driveways, sidewalks.



FAR-INFRARED RADIANT HEATERS

For annealing, calendering, curing, drape forming, drying, preheating, embossing, forming and shaping, fusing of cast

embossing, forming and shaping, fusing of cast films and sheets, heat sealing, ink and paint drying, laminating, planishing and polishing, postforming, slush molding, transfer molding, resin curing and finishing, setting paper additives and coating, vacuum forming, vinyl fusing.



BLOWER TYPE UNIT HEATERS

For larger areas requiring greater amounts of heat distribution . . . such as factories, garages, machine

shops, drying rooms. For areas where positive circulation is desired to maintain uniform temperatures... such as warehouses, garages and plant offices.



IN-DUCT TYPE HEATERS

For mounting in forced air ducts to supply heated air for ovens, dryers, space heating, process work.



BASEBOARD HEATERS

Perimeter heating for homes, offices, lobbies . . . anywhere the ultimate in comfort heating is desired.

UNIT VENTILATORS

Electric heating and fresh air ventilating for schools, churches, theaters, plant meeting rooms, gymnasiums, lobbies . . . wherever large numbers of people congregate in a restricted area.





PREMIUM Quality IN THE GARCY TRADITION AVAILABLE NOW AT A LOW-BUDGET PRICE

The New Gar-Lite 101 by GARCY LIGHTING

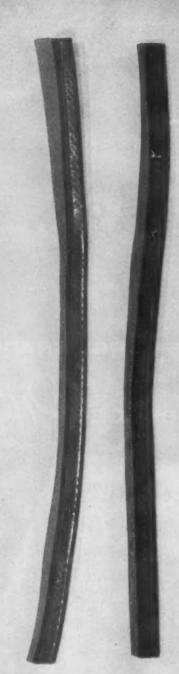
Exclusive one-piece shield combines two tones, does two jobs Diffuse white sides prevent objectionable side brightness Clear prismatic bottom offers controlled high efficiency Shield hangs down from either side on continuous hinge Two-lamp unit (illustrated) is less than 9" wide, 3¾" deep Exact 48" length; joins end to end quickly and easily

Write for Bulletin 59

AVAILABLE THROUGH SELECTED GAR-LITE DISTRIBUTORS

GARCY LIGHTING

DIV. OF GARDEN CITY PLATING & MFG. CO. 2475 ELSTON . CHICAGO 47, ILLINOIS



Which one is brand new?

Which wire has 12½ years of service?

Both specimens in the photograph are protected with a tough durable covering of neoprene. And that's why you can hardly tell the difference between old and new. The one on the left has been in outdoor service in northern California for 12½ years, yet it still looks as good as the new one on the right.

Performance like this proves neoprene's ability to withstand sun, weathering and aging. It is the reason many telephone companies have standardized on neoprene jacketing.

Neoprene also resists chemicals, temperature extremes, impact damage and cold flow. This time-tested jacketing material assures you long-term protection and economy.

Neoprene-jacketed wire manufactured by Whitney-Blake Co.

For more information about neoprene write to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EC-9, Wilmington 98, Del.



SYNTHETIC

RUBBER

NEOPRENE HYPALON® VITON® ADIPRENE®

Better Things for Better Living . . . through Chemistry



GOLD SEAL

RUBBER TAPE for easy handling and instant fusing

Here's the tape for high voltage insulation! Easy to work with, Gold Seal Rubber Tape fuses together instantly, provides long-life insulation protection. With its high dielectric strength and ability to conform to irregular shapes, Gold Seal makes a perfect insulating splice. Jenkins Bros., Rubber Division, 100 Park Avenue, New York 17.



Gold Seal Tajoe

Gold Seal Friction • RUBBER • Plastic Tapes...,

Commercial and Specification Grades

In 10-roll containers or single rolls. Each roll sealed in cellophane, stays fresh.

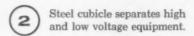
Ultimate in protection

for men and machines

Here's the last word in control protection for personnel and equipment! It's all part of Allis-Chalmers newly designed, high voltage control.



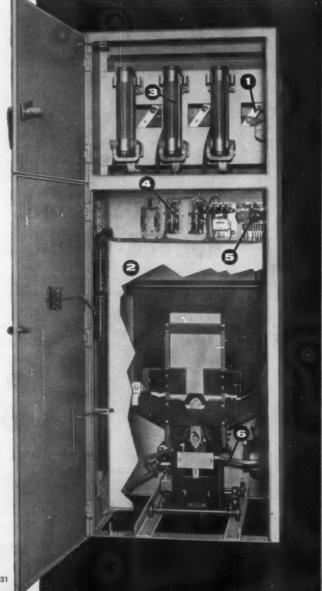
Gang-operated disconnect switch isolates starter from incoming power—assures safe entry to high voltage compartments.



- Short-circuit protection provided by fast-acting current-limiting fuses, rated 150,000 kva at 2300 volts and 250,000 kva at 4160 or 4600 volts.
 - Overload protection provided by accurate temperature-compensated thermal overload relays which trip only with excessive motor current, preventing needless motor stoppages.
- Undervoltage protection instantaneously opens line contactor on loss of voltage. Time-delay undervoltage protection also available.
 - Mechanical interlock coordinates contactor, disconnect switch, outer door and inner control barrier for maximum safety.

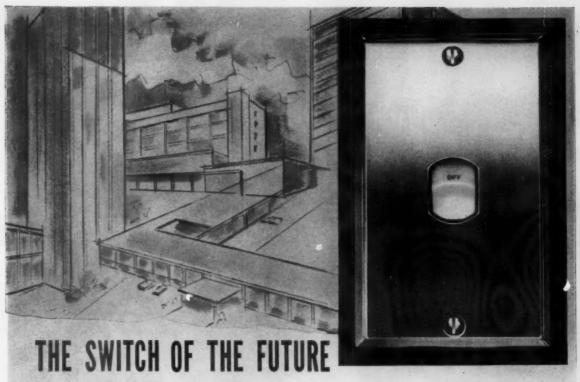
This starter line meets every 2300 to 5000-volt motor need. Contact your A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

And maximum protection is only one of the features of this new control line. You also get full-front access, smaller cabinet size (2.36 square feet less than competitive units), a completely tested unit, and ample panel space for optional features.



ALLIS-CHALMERS





Many of today's switches are specialties primarily designed for appeal in decoration. Others are designed to meet the rugged use and performance called for by a heavy duty switch.

is being used NOW!

Now, one new switch, Rocker-Glo, combines eye-appealing design with heavy duty performance. So impressed with this combination are architects, engineers and contractors that Rocker-Glo is already being specified in leading hotels, motels, hospitals, commercial buildings and housing developments. Rocker-Glo has high-grade silver alloy contacts and positive make-and-break rocker arm construction. Its modern design and unique construction allow this switch to be pressed, pushed, rocked or rolled into instantaneous action.

Rocker-Glo switches are specification grade AC switches designed to be used at full current rating on tungsten filament and fluorescent loads (one switch takes the place of two ordinary AC-DC switches on fluorescent loads). It can be used anywhere old style toggle switches are used.

And Rocker-Glo's clean functional lines and soft beauty lend the final decorative touch.

Available in Despard interchangeable type, Despard type mounted on a strap and narrow rocker for tumbler switch plates. A specification grade switch, 15 and 20 amps. 120/277 volts AC.

ROCKER-GLO





Write for free Rocker-Glo bulletin – Dept. ECM-959



PASS & SEYMOUR, INC.

SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. • 1440 N. Pulaski Rd., Chicago 51, III. • In Canada; Renfrew Electric Limited, Renfrew, Ontario



1959–15,000,000 horsepower **1965**–26,000,000 horsepower

Conservative estimates place the total horsepower of all motors driving fans and blowers in the United States at about 15,000,000 horsepower. And in 1965 it is estimated that the total will be about 26,000,000 . . . an annual growth of 5% for the air moving industry. To make sure all this equipment gives top performance requires careful matching of motor to equipment . . . and a wide variety of different types of motors. Century Electric application engineers can help you select the right motor for your fans, blowers and allied equipment:

For fans—Two basic types of motors, CS and CP, meet most requirements for fans operating from single phase power. Both these Century Electric capacitor start motors provide high starting torque. Fans operating from polyphase power perform best with SC and SCM motors.

For blowers—If the starting load is light or if there will be short time increases in load, then the Century Electric Type SC polyphase motor is ideal. It will give you enough starting torque, and with low starting current. It comes in ½ to 400 hp sizes. If you need two, three or four different fixed speeds while the blower is running, the Century SCM polyphase motor will do the job.

For compressors—Where high starting torque is required to overcome great inertia or back-pressure, the Century Electric Type SCH polyphase motor is right. This motor comes in sizes ranging from three to 400 hp and in dripproof,

totally-enclosed and explosion-proof enclosures. It also provides the right kind of power to drive reciprocating pumps with high starting torque requirements.

For pumps—Centrifugal pumps, whose torque demands increase with speed, perform best with Century Electric SC polyphase motors. Reciprocating pumps with high starting torque requirements need the SCH. For all types of pumps, as well as for compressors and blowers, Century Electric makes single phase motors.

For special applications—Century Electric makes a variety of motors for specific operating conditions. The shaft-mounted fan motor is designed for unit heaters and evaporators. It comes in ½ to 3 hp sizes. Hermetic motors can be built right into a refrigeration compressor unit... they are manufactured under rigid quality controls to make sure they are free of contaminants that could damage capillary tubes and valves.

FOR MORE INFORMATION
—Please contact your nearest
Century Electric Sales Office or
Authorized Distributor. You
will find Century Electric's
new Motor Application Guide
helpful . . . please write for
bulletin 270A. For more than a
motor . . .



CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri Offices and Stock Points in Principal Cities



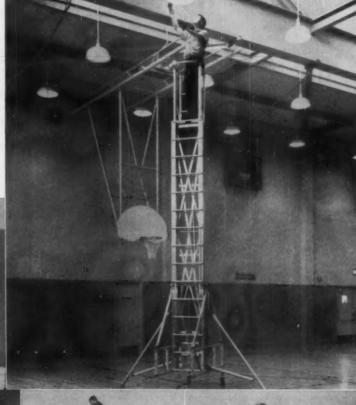
FROM OVER 10,000 TYPES of motors—AC and DC . . . single phase and polyphase . . . from 1/20 to 400 hp—you can find the right one from Century Electric for your application . . . the one that provides the best performance commensurate with cost.





TALESCOPE ...telescoping aluminum work platform for overhead construction and spot maintenance

Lightweight, rapidly assembled by one man. Extends instantly for reaching heights up to 30 ft. Telescopes for rolling under trusses and other obstacles. Adjustable legs for uneven floors or stairways.









Separates easily into 3 components for convenient stor

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Phelps Dodge Habirite-Habirprene Cable with Wire Shield!

Phelps Dodge pioneered the use of a wire shield as a standard item in power cable construction. From this background and experience. Phelps Dodge developed its outstanding Habirite-Habirprene high voltage cable with a wire shield. This cable offers a number of advantages over ordinary "RR" cable with tape shield including:

- Greater flexibility; minimum bending radius in most cases is less than half the bending radius of tape-shielded cable, making installation easier in confined areas.
- Rugged wire shield can be braided or bunched for use as a ground lead at splices and terminations. Intermediate steps in making ground connections are eliminated, saving time and effort.
- 2 Dependable wire shield continuity provides protection against hidden shield rupture which can occur during installation or in service.
- A Overall wire shield resistance is constant without the variations found in tape-shielded cable.

Habirite-Habirprene cable with a wire shield assures you the utmost in safety, durability and handling ease.

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Protection

Is MODERNIZED

with BUSS Fuses

in the

TAMPA CITY HOSPITAL

Tampa, Florida

In this beautiful hospital, tremendous in size, it was found necessary to increase the capacity of the electrical system to meet today's requirements. Modernization of the electrical system resulted in estimated available fault currents of 150,000 amperes.

With faults of this magnitude possible, it became essential that a superior type of protective device be used.

So in the main switch board are BUSS Hi-Cap fuses and FUSETRON dual-element fuses, both applied to give the interrupting capacity and dependability needed on the circuits they protect.

ANOTHER BUSS HI-CAP AND FUSETROI

FUSETRON FUSE INSTALLATION



ARCHITECTS AND ENGINEERS: Norman F. Six and Elliot C. Fletcher, Tampa and Schmidt, Garden and Erikson, Chicago

CONTRACTOR: Miller Electric Co., Jacksonville, Fla.

WHY HIGH INTERRUPTING CAPACITY IS NEEDED

Fault currents of 75,000 or 150,000 amperes were unheard of a few years ago, — but today they are quite possible. With the generating capacity of utilities increasing yearly, most likely the magnitude of fault currents will be higher in future years.

BUSS Hi-Cap and FUSETRON dual-element fuses have an interrupting capacity designed for today's conditions and to anticipate system growth.

The interrupting rating of BUSS Hi-Cap fuses is 200,000 amperes rms symmetrical — and for FUSE-TRON fuses it is 100,000 rms symmetrical.

WHY DEPENDABILITY IS NEEDED

With higher fault currents available, the dependability of the protective device becomes of increasing importance.

The protective device should be just as accurate in 10, 15, or 20 years, as it is on the day installed.

A fuse is the only type of protective device to offer this advantage. A fuse must remain safe and accurate, as its operation depends on a simple thermal law. A fuse has no triggers, latches, pivots or contacts to stick or get out of order. Dust, fumes, corrosion or age cannot increase a fuse's capacity or lengthen its blowing time.

for more information

On FUSETRON dual-element fuses - (loads of

0 to 600 amps.) - write for bulletin FIS

On BUSS Hi-Cap fuses - (loads above 600 amps.) - write for Bulletin HCS

959

BUSSMANN MFG. DIVISION, McGraw-Edison Co. ST. LOUIS 7, MO



Inside story of

SCOTCHCAST Resin Splices

"SCOTCHCAST" BRAND Resin No. 4 is an epoxy resin developed especially for field splicing. Weathering, moisture, pressure, or general aging encountered in normal burial or overhead service does not affect itfield splices can now have the same modern, completeprotection and insulation as shopcast motor coils, transformers, and condensers. Convenient kits assure positive electrical insulation, corrosion protection, moisture resistance, and trouble-free maintenance splice after splice!

"SCOTCHCAST" SPLICING KITS



Rits feature "SCOTCHCAST"
Resin No. 4 in single-use
"Unipak" Container. Two-Part
plastic bag contains resin and
hardener. To use, bag divider
seal is broken; laboratory correct mixture results. Resin is
poured right from bag into mold;
sets in minutes. Kits are for use
on all non-shielded cable splices.

"SCOTCHCAST" RESIN PRESSURE SPLICE



With the "SCOTCHCAST" Resin Pressure Method, cable splices and Pressure Method, cable splices and terminations, regardless of size or configuration, can be insulated easily . . . difficult jobs such as shielded cable splices, terminations, and sheath repairs are readily accomplished. Method utilizes "Scotchcast" Resin No. 4 in "Unipak" container injected into a screen-fabricated mold by specially designed pressure gun.





Cut-away inline splice shows com-plete penetration of resin with pressure-splice method. Will in-sulate splices on rubber, synthetic or lead insulation or sheath cable ... shielded and unshielded.



82-B Series Kits for excellent electrical and physical protection of wye splices with cable O.D.'s from ¼' to ¾'. Cut-away shows moisture proof penetration of "Scotchcast" Resin No. 4 into all voids of splice mass.



Shielded wye splices are easily handled with "SCOTCHCAST" Pressure Splice Method. Shielding con-tinuation is built into the splice insulation. Total moisture and physical protection is an extra feature of this method.

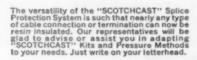


90-B1 Kit for positive protection TO-SI KW IOF positive protection of wye or tap splice, insulation over split-bolt connectors or control cable taps. For surface or underground uses. Like all "SCOTCHCAST" Kits, assembles quickly and easily; gives electrically tight splice protection without need of special skills.



ed is for use at 9 KV. Lower cutaway portion shows stress cone. Entire termination—including stress cone—is resin saturated in one operation. Available in building block components up to 15 KV.

Outdoor cable termination illustrat-



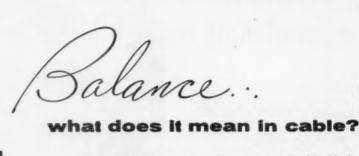
FREE BOOKLET describes "SCOTCHCAST" Krts and Pressure-Splice Method. Illustrates applications; details electrical properties. Write: 3M Co., 900 Bush Ave., St. Paul 6, Minn., Dept. EAW-99.



MINNESOTA MINING AND MANUFACTURING COMPANY

... WHERE RESEARCH IS THE KEY TO TOMORROW





No one characteristic alone determines good cable. It's the right balance of many qualities that counts. Carol has this balance. Look at these significant test results.

	BRAND			
	CAROL	A	В	C
Electrical Insulation Resistance (1)	100	17	16	68
Cold Bend °F (2)	-50	-45	-90	-50
Abrasion Resistance (1)	91	62	100	92
Ozone Resistance (1)	100	6	18	12

Note: (1) 100 indicates best-others % of best (2) cold bend-actual test temperature

As can be seen, needlessly high cold flexibility can be built into cable...but only at the sacrifice of more important electrical properties. And in Brands A, B and C you will also note the lack of balance between abrasion resistance and ozone resistance...which means these cables can crack long before they wear out.

Carol, on the other hand, has not only the highest combined rating but is also the best balanced. As a result of years of experience and research, primary emphasis has been placed on the characteristics most vital in cable life and performance.

To you, this means superior quality throughout...extra quality and performance where it is most needed.

when you call for cable—call for Carrol®

PORTABLE CORDS . POWER SUPPLY CABLE . CONTROL CABLES . WELDING CABLE . GOVERNMENT TYPES . CORD SETS

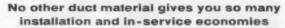
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1959

Get peak cable protection at lowest dollar cost



Transite Ducts can be laid directly in trench without concrete envelope. Or if ductbank is to be concrete enclosed—thinner walled Transite Duct may be used. In all other respects both heavy-wall and thin-wall Transite Ducts are identical.

Transite Ducts save on the job and after!





In every way, Transite[®] Ducts are the most efficient electrical ducts you can install. And—when assembled with J-M's Plastic Coupling their cost is remarkably low!

One reason for this economy is in installation. Strong, lightweight, long—Transite lengths are easy to handle and install . . . Your men set the ducts in place easily, join them tightly in seconds. Transite's smooth bore is free of burrs and obstructions. Thus, long cable pulls are easily accomplished with no damage to cable sheathing.

You see another reason for Transite's economy in performance. Once in service, Transite's unusually high rate of heat dissipation means cables run cooler, last longer. Transite also confines arc damage... cannot burn, smoke or fume. It won't generate explosive or toxic gases. If arcing does occur, Transite Ducts won't sag or adhere to cable.

Let us send the Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE



8-wk shipment, 4-hr installation with G-E RM medium transformers

Shipment in eight weeks; installation in four hours. These are examples of the full value for your transformer dollar you get with General Electric RM (repetitive manufacture) medium transformers. Maintenance time also is reduced on these units.

For industrial users whose primary or secondary power load exceeds 500 kva, General Electric RM medium transformers offer many advantages. Now RM medium transformers feature interchangeable transformer-breaker bushings, lower sound levels, and improved pressure-relief devices. Other units in G.E.'s full line of transformers meet specialized industry requirements.

Faster order handling and shipment plus product leadership are key reasons why you get certified full value for your dollar with General Electric's full line of transformers for industry*. But be sure to factor in the complete G-E service provided before, during, and after installation. If you examine the complete package, we're confident you'll recognize the full value for your transformer dollar offered by General Electric.

For complete information and application help, see your G-E Apparatus Sales Engineer or Agent today. Or write for descriptive literature to Sect. 417-7, General Electric Company, Schenectady 5, New York.

* Medium transformers (501 to 7500 kva), Open dry-type transformers (300 to 7500 kva), Sealed dry-type transformers (300 to 7500 kva), Distribution Equipment transformers (112½ to 500 kva), Integral Distribution Centers.

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COMPLETE SERVICE . . . application engineers . . . installation engineers . . . 50 nearby service shops,

Simplify interlocked armored cable installations



and T&B accessories readily solve specific installation problems . . .

WITH NEW T&B FITTINGS

Each size of the new T&B Interlocked Armored Cable Fittings accommodates twice the previous range of cable sizes. They eliminate the problem of armored cable OD that is too large or too small for the fitting. The extra armor stop in T&B Interlocked Cable Fittings and the independently-bolted twin saddles make it possible to accommodate a wide range in armor diameters. The saddles are serrated for positive grip.

For dry or wet locations — T&B Armored Cable Fittings are available for both terminating in boxes or dead-ending, in both dry and damp locations. (Damp location fittings have a neoprene bushing, retainer ring and gland nut to keep out moisture.)

Other advantages: 1) Fewer connectors are required to accommodate the full range cable sizes. Fewer items in stock. 2) There is only one connector for each hub thread size. 3) The basic connector and its accessories are engineered to achieve LOWEST INSTALLED COST.

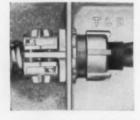
All T&B products available only through authorized T&B distributors

THE THOMAS & BETTS CO.



34 Butler Street, Elizabeth 1, New Jersey Thomas & Betts, Ltd., Montreal, P.Q., Canada

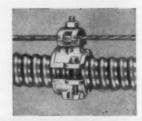
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



FOR WET LOCATIONS



FOR GROUNDING



FOR HORIZONTAL SUPPORTING



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For complete details, contact your local T&B distributor or write for Catalog 1A2.

NOW! ALL WITH DOORS

...panelbase assemblies for 12, 20, 30 & 42 circuits



FRANK ADAM LOAD CENTERS

With these new @ Load Centers—with space for 12, 20, 30, or 42 single-pole circuits—you can reduce wiring time, cut equipment cost and furnish a much better, more compact installation.

Doors are now standard on all Frank Adam Load Centers, from 12 to 42 branches. Conceals branch circuits—protects them from possible damage—helps discourage unauthorized use— makes a neater, more attractive installation.

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All contacts and bus bars heavily electro silver plated. One-piece galvanized enclosures, roomy gutters ALL sides, plenty of knockouts. Sequence bussing permits any pair of single-pole breakers to be made into double-pole with handle extension. Panel-base adjustable for flush or surface mounting. UL approved for label service.





THE ELECTRIC COMPAN'

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Dusduct · panelboards · switchboards · service equipment · safety switches · load centers · Quikhels

QP QUICKLAG-P CIRCUIT BREAKERS

... most dependable, safe circuit protection made

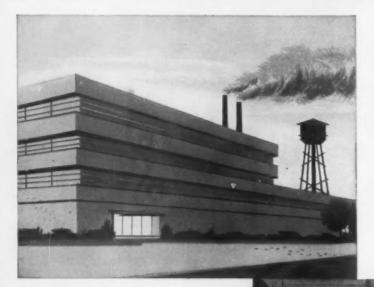
Thermal magnetic—quick-make, quick-break. Trip-free handle prohibits handle from being held closed on overloads and shorts. Time lag feature prevents tripping on momentary harmless overloads.



CAPACITIES: 10, 15, 20, 30, 40 and 50 amps. 2-pole and 3-pole common trip breakers available.

TREMENDOUS MARKETS

for Exide Lightguard emergency lighting units



Industrial

Easy to sell

Every factory needs protection against sudden darkness. If lights go out, they risk heavy losses . . . from injury, panic, equipment damage. Exide Lightguard units give complete protection. Most customers buy several. Profits for you are substantial. Try it and see.

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Stores and restaurants, offices and theaters need light in key areas all the time. Sudden darkness gives thieves a field day. Crowds panic. Yet the fact is most businesses still don't have emergency lighting. Be first to profit. Tell them the Exide Lightguard story.

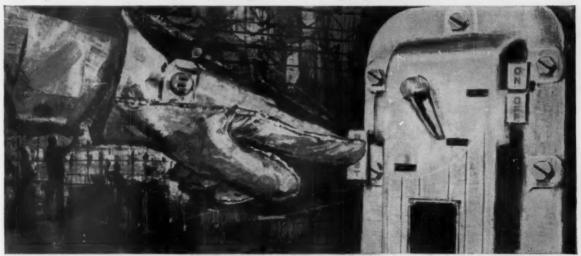




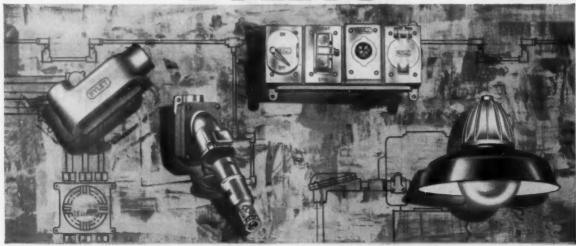
Easy to install. Completely self-contained. Exide Lightguard units plug into regular power outlets. Go on automatically if power fails. Flood large areas with light. Only Exide Lightguard offers the extra safety of genuine Exide batteries and built-in charger. Better protection. Less cost per year. For information on becoming an Exide Lightguard dealer, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



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PYLET conduit fittings, circuit controls, lighting fixtures and connectors are second to none for quality and dependable service.

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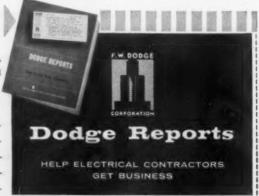
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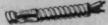
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LIGHTING ADVANCES FROM

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forerunners of wonderful things to come

4 PROFIT MAKING REASONS WHY IT WILL



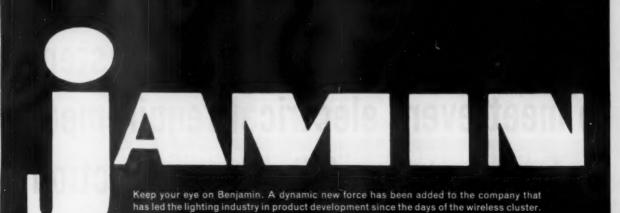
FASTEST SELLING COMMERCIAL FIXTURE IN ITS PRICE RANGE!

The Catalina is available with Benjamin's own 45° plastic louver or the exclusive new L-120 lens. Now architects have new freedom of design ...contractors like the minimum installation time required for the simple two-piece construction... consulting engineers find a new ease of wiring and fixture layout. This plus modern design makes the Catalina today's most popular lighting fixture!



A NEW FIXTURE FOR THE SCHOOL AND OFFICE LIGHTING MARKET!

Designed to give you more features and lighting qualities than any similar unit on the market today. Available with popular 35° x 25° or 45° x 45° shielding in two or four lamp arrangement. Simplified butt mounting arrangement affords rigid, continuous row installation and assures perfect alignment of fixtures. Dollar for dollar, the Versateer has no equal.



tradition of quality with outstanding Thomas merchandising facilities.



Benjamen

This strong combination gives you a positive pledge of new products and promotion—a promise of new horizons for all in the business of lighting.

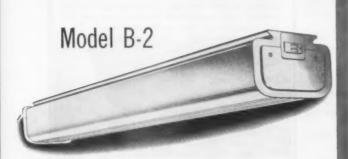
Now, Benjamin Electric has joined forces with Thomas Industries, combining a Benjamin

Your local Benjamin representative will be happy to help you. Contact him on any problem ...large or small.

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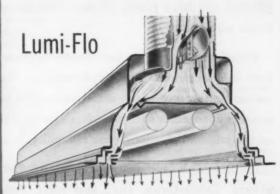
These products are sold only through qualified Benjamin wholesalers

PAY YOU TO KEEP AN EYE ON BENJAMIN!



NEW "B" SERIES COMMERCIAL FLUORESCENTS

Unit packed simplicity is the keynote for this new line of plastic enclosed fixtures. Designed for low cost store and office lighting in the two-lamp version and for high quality corridor lighting in the single lamp type. The polystyrene plastic cover snaps into the channel offering a rigid, trouble-free installation that makes lamp replacement and cleaning easy.



WORLD'S FIRST AIR CONDITIONING LIGHTING FIXTURE COMBINATION!

Truly the most versatile fixture ever created. Benjamin research and pioneering has made available this tested and approved Trofferlite that delivers quality lighting, draft-free air conditioning and now wintertime heating. The triple-duty Lumi-Flo offers installation short cuts and cost cutting maintenance features never before possible.

There's a General Electric Underfloor Wiring System to meet every electrical requirement ... for any type of floor construction

Practically any combination of structural and electrical specifications can be met by using one of General Electric's four steel underfloor wiring systems. For all types of floor construction... slab and fill, monolithic, lift slab, steel deck, wire mesh form... you can pick a G-E system that perfectly matches the application. And no matter what the electrical requirements... high density power wiring or a maze of telephone lines... you'll find that a G-E system can take care of the job and still have plenty of room left for additional wiring later on.

Installation is simple, too. That's because all four G-E systems are straightforward in design and accurately made to close tolerances. The components fit together without difficulty—save time on the job, and give long-term reliability.

All four G-E systems are listed by Underwriters' Laboratories, Inc., and meet Federal Specifications.

G-E UNDERFLOOR WIRING SYSTEMS ARE EASY TO INSTALL



All G-E underfloor wiring systems are easy to install. For example, with the G-E single-level systems all duct runs may be fed through conduit openings in the corners of the boxes—no need for field adaptations to feed center duct runs.



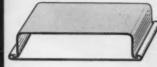
Another important point: screws in the leveling ring of all G-E single-level junction boxes permit fine adjustments to bring the box level with the fill—without need of removing the box cover.

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GENERAL & ELE

FOR CELLULAR-STEEL FLOORS



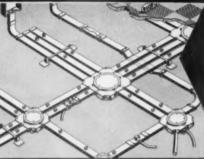


G-E HEADER DUCT
9.03 SQUARE INCHES
INTERIOR
CROSS-SECTIONAL AREA

The G-E cellular-steel floor wiring system makes it possible to locate outlets in every 6 inches of floor area. A special capped header allows you to provide for future expansion at low initial cost.

G-E header duct offers 9.03 square inches interior cross-sectional area to provide for ever-increasing electrical needs, will accommodate 110 No. 14 Awg wires in accordance with the National Electrical Code.

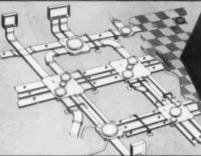
FOR CONCRETE FLOOR CONSTRUCTION

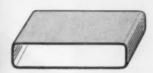




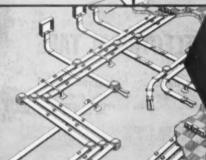
SINGLE-LEVEL
STANDARD DUCT
3.357 SQUARE INCHES
INTERIOR
CROSS-SECTIONAL AREA

In standard layouts—The G-E single-level steel standard duct system offers up to 3 services. Supplementary feeding through conduit is possible through corners of durable, cast-iron junction boxes. These boxes afford easy leveling and cover adjustment, and provide large openings for wire pulling. Compartments are available to separate services in double and triple boxes. Can be installed in fill as shallow as $2\frac{1}{2}$ ". Duct will accommodate 41 No. 14 Awg wires, in accordance with the National Electrical Code.





SINGLE-LEVEL BIG DUCT 8.414 SQUARE INCHES INTERIOR CROSS-SECTIONAL AREA For greater feeding capacity—G-E single-level steel BIG DUCT system with an 8½" cross-sectional area will accommodate 102 No. 14 Awg wires. System includes boxes, components, and accessories necessary to use BIG DUCT either by itself or with G-E single-level standard duct. Can be installed in any type of floor that has a minimum fill thickness of 3 inches.





TWO-LEVEL DUCT
4.007 SQUARE INCHES
INTERIOR
CROSS-SECTIONAL AREA

For difficult feeding problems—The G-E steel two-level duct system is recommended for fills of $3\frac{1}{2}$ " and over, particularly where feeding must be accomplished from many locations. It allows complete separation of services. All feeding is done by duct on the lower level, distribution on the upper level. Ducts bypass intervening junction boxes; need for conduit home-runs is eliminated. Will accommodate 49 No. 14 Awg wires, in accordance with the National Electrical Code.

For valuable manuals containing complete layout, design, product, and installation data, mail the coupon today The General Electric Company
Conduit Products Department, Section CU-88A-918
Bridgeport 2, Connecticut

- Please send me your bulletin on singleand two-level steel underfloor wiring systems.
- Please send me your bulletin on cellularsteel floor wiring.
- Enclosed is a description of my underfloor wiring problem. What do you suggest?

Company ...

City

9

Title



Porter QUIK-STIK POLYETHYLENE ELECTRICAL TAPE

- Ideal for all outdoor and indoor, underground or overhead wiring, in utilities, electronics, aircraft, automotive, and general use.
- · One-wrap, single-wind primary insulation.
- Permanent strong tack . . . fast-sticking anywhere!
- Dielectric strength tested to 1,000 volts per mil; uniform power factor over wide frequency range.
- Low moisture-permeability, high abrasion- and corona-resistance.
- Resists acids, alkalies, oils, solvents, fungus, bacteria, gases.

Get full information on Porter Quik-Stik polyethylene tape by writing today to Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.

THERMOID DIVISION



H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specially Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—Connors Steel Division, Vulcan-kidd Steel Division; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Ganada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD

NEW SERVICE ENTRANCE EQUIPMENT



200-AMP CAPACITY... CIRCUIT BREAKER CONVENIENCE ... AT A COMPETITIVE COST

You will like the extra convenience of Heinemann's new 200-amp service entrance equipment . . . and so will your customers.

Trim, compact, smaller than comparably rated fused pull-outs, these units offer considerable savings in terms of easier installation and more efficient operation.

Installation features would make an apprentice happy. Wiring space is plentiful . . . connections are easily made with solderless screw-type connectors . . . knockouts are placed so that you can run-in conduit from any angle.

Completely non-thermal, the magnetically actuated Heinemann circuit breaker eliminates nusiance tripping and other temperature-caused troubles. You can therefore locate the unit wherever most convenient . . . next to heat lines or out in the hot sun, if neces-

sary. The breaker will always carry full rated current, will always trip as specified.

Breaker protection provides other conveniences as well: no bothersome fuse changing, simplified switching: the switch handle has only two positions: ON and OFF. No reset position; no confusion possible.

Rated at 120/240V AC, two or three wire service, the new Heinemann service entrance equipment is available in outdoor or indoor enclosures. Both are of heavy-duty steel in a grey baked enamel finish. Outdoor enclosures are raintight, with hinged covers that may be padlocked against tampering.

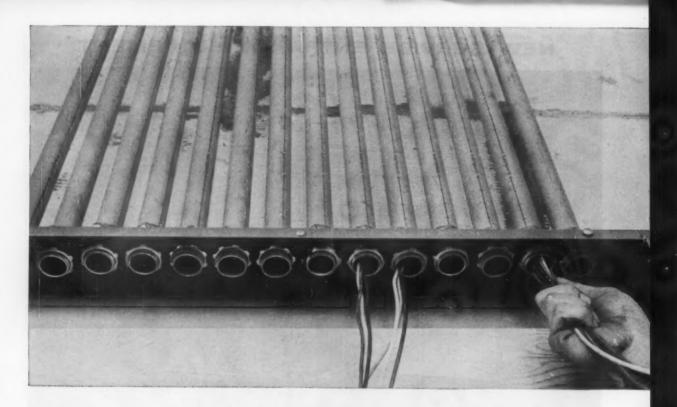
You'll be pleasantly surprised by the cost. It's little more than that of comparably rated fused equipment.

For full information send for Bulletin 1003

ELECTRIC COMPANY Circuit breakers



S.A. 1959



IN OFFICE BUILDING CONSTRUCTION...CLEVELAND, OHIO

THE BEST COSTS



3101 Euclid Avenue Building, Cleveland, Ohio
Designer and General Contractor: The H. L. Vokes Company
Electrical Contractor: Doan Electric Company

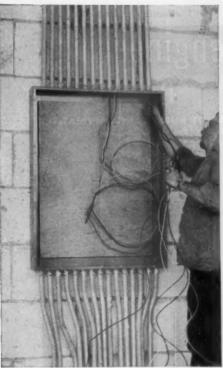
Where beautiful, modern buildings are constructed—like the 3101 Euclid Avenue Office Building, Cleveland, Ohio—Republic ELECTRUNITE® E.M.T. is on the job.

In measuring, bending, installing, wire pulling operations, ELECTRUNITE E.M.T. offers advantages and economies to the user and over the years its service life proves . . . the best costs less installed!

Lightweight, easy to handle ELECTRUNITE is made of highest quality flat-rolled, open-hearth steel. Carefully inspected through every step of manufacturing to assure quality is built-in.

Republic Electrunite E.M.T. is produced to A.S.A. Specification C80.3, Federal Specification WWT-806, and carries the Underwriters' Laboratories Seal of Inspection.

To insure quality and protect your estimates, remember the best costs less installed—specify Republic ELECTRUNITE E.M.T. For more information, call your local Republic ELECTRUNITE distributor. Or, use coupon and write direct.



"EN VERELIEV" WITH "INSIDE-KMIRLING" OF exclusive Republic ELECTRUNITE E.M.T. feature, combines ballbegring like surface with a new inside finish to reduce friction. Wire pulling is as much as 37% easier. Wire pushing is substantially easier, too.



"GUIDE-LINE"® extends the full length of ELECTRUNITE E. M.T. Tubing. By properly aligning the "GUIDEwith calibrations on the Republic Bender Tool, bends are kept in the correct plane, avoiding costly "wows", wasted time, and wasted material.



EXCLUSIVE "INCH-MARKS"® make quick, accurate measurement a cinch. Every length of Republic ELECTRUNITE E.M.T. is like a 10-foot rule-marked off in feet and inches. Simply measure and cut. Cut-away section, photo above, reveals exclusive "INSIDE-KNURUNG".

NSTALL



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World's Widest Range of Standard, Steels and Steel Products

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1441 REPUBLIC BUILDING . CLEVELAND 1, OHIO

Please send more information on the following products: ☐ Republic ELECTRUNITE E.M.T. ☐ METAL LUMBER ☐ Republic Bending System

Title-Name.

Firm_

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1959



Now . . . a complete new line

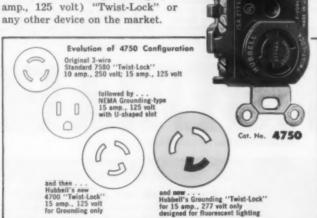
15 Ampere

277 VOLT GROUNDING ONLY Twist-Lock

for fluorescent lighting applications

listed by Underwriters' Laboratories, Incorporated

This exclusive new Hubbell line of caps and receptacles is specifically designed for 15 amp., 277 volt circuits widely used for fluorescent lighting. The devices are non-interchangeable with regular "Twist-Lock", 4700 line, grounding (15 amp., 125 volt) "Twist-Lock" or



Cal. No. 4750

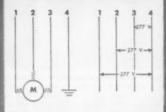
For complete information write ... the only 15 amp., 277 volt duplex locking and grounding receptacle on the market ... feeds two fluorescent fixtures from one single gang box...cuts number of receptacles and boxes in half ... saves hours of installation and maintenance time.

engineering news

HARVEY HUBBELL, INCORPORATED Engineering Department

WHY A 4750 LINE FOR 277 VOLT **APPLICATIONS?**

480 volt, 3-phase, 4-wire circuits, commonly used by industry for heavy electrical equipment, are impractical for lighting and other applications requiring lower voltages. To overcome this drawback many firms divided r 480 volt service into three light-



ing circuits of 277 volts each (see diagram). Unfortunately, no wiring device rated at 277 volts existed, and 20 amp., 600 volt receptacles, caps and connectors had to be used for fluorescent lighting. The 20 amp, units, available in single receptacles only, were bulky and expensive, requiring twice the space and twice the effort to install to install

In answer to this problem, made more in answer to this problem, made more urgent by the increasing use of 277 volt circuits for fluorescent lighting, and equipment designed for 277 volt circuits, Hubbell developed a complete line of locking grounding devices to meet code requirements for 277 volt fluorescent and other equipment designed for 277 volt service. This line of devices, designated as the 4750 line, provides safe and positive grounding plus locking convenience and protection. It features the first and only 277 volt duplex locking and grounding receptacle on the market. This unit, cat. no. 4750, feeds two fixtures from one single gang box, cuts the number of devices needed in half...cuts cost of boxes in half and saves hours of time on both fixture installation and maintenance. urgent by the increasing use of 277 volt

HARVEY HUBBELL, INCORPORATED

BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE OFFICE AND WAREHOUSE LOCATIONS

Bridgeport 2, Connecticut State and Bostwick Streets Chicage 7, Illinois 37 South Sangamon Street Les Angeles 12, California 103 North Santa Fe Avenue San Francisse, California 1675 Hudson Avenue

IN CANADA: Scarborough, Ontario, 1160 Birchmount Boad



When Lights Go Out

Manhattan's worst power blackout came on a muggy August Monday. Air cooling devices in the great Central Park area of midtown New York City were pushing the demand above 140 megawatts during early afternoon when a succession of 13.8-kv cable failures occurred. After seven of 20 high voltage cables went out the power was disconnected to save the huge network from further damage which might have taken months to repair.

The load was short of a record for the area. The system had handled 176 megawatts earlier in the summer without trouble. The failure could not be attributed to any one clear cause. More than likely they occurred as a coincidence of several factors. The restoration of normal power within 13 hours was a magnificent piece of coordinated work considering the magnitude of the area involved and the extremely complex pattern of the network system.

Most immediate civil concern centered on the 13 hospitals affected. Several had some measure of "emergency" lighting. Police, fire and civil defense generating equipments were available, useful for disaster conditions, but hardly adaptable to the extensive, precise and exacting electrical requirements of a modern hospital even under emergency conditions.

The high reliability of utility power in the area is such that emergency power was a minor worry to hospital authorities—if they thought about it at all. The blackout found them unable to cope with even the ordinary routines of a normal midsummer night. And utility spokesmen could offer no assurance that unpredictable events could not result in a similar or worse failure at another time.

Particularly in our big cities, but also in our suburbs and shopping centers, we have become totally dependent upon electric power. Many of our homes and buildings rapidly become untenable if power fails for any substantial period of time. The records of our utility systems need no apology. But they will never reach total perfection. Power failures are rare, but they do happen. In key community facilities they should be anticipated and planned for.

The lesson from New York should be considered well in every community. Our hospitals obviously need built-in standby power, not only generation but a complete system of priority circuits if it is impractical to provide for full load. Other key community services; for example, public buildings, schools, auditoriums and stations; should be equipped for whatever disaster relief they may have to serve. Our total dependence upon electric power resulting from its high reliability makes it essential that we have islands of prepared, self-contained shelter, comfort and security capable of carrying our communities through a major power failure.

Um. T. Strait



IS ALUMINUM CONDUIT AS GOOD AS STEEL?

An appraisal by R. G. McIlroy, president of the first company to manufacture both kinds

Probably no electrical product is more talked about today than rigid aluminum conduit. You've all been exposed to a tremendous amount of advertising, editorials, and trade exhibits on the subject. Many of you have been contacted directly by producers of aluminum conduit.

Now the time has come when all of us —manufacturers, distributors, contractors, engineers and utilities—must thoroughly investigate this product and decide where we go with it.

We at Pittsburgh Standard are in a particularly good position to help make this evaluation, for we are the first manufacturer of rigid steel electrical conduit who is also producing and selling rigid aluminum conduit.

Our prime consideration is whether aluminum serves the basic purpose of an electrical raceway as well as, or better than steel conduit, regardless of price. There are some who like aluminum conduit because it's new; there are some who will not use it because it is new. But facts will decide the case, and here are the facts as we see them.

THE ALUMINUM SIDE OF THE STORY

What comes to the fore immediately is the tremendous weight advantage of aluminum. A standard 10-foot length of 1-inch aluminum conduit weighs about 6 pounds, while its steel equivalent weighs about 16 pounds. One 4-inch piece of conduit weighs 38 pounds in aluminum as compared to 100 pounds in steel. Thus, one should expect significant savings in costs of handling, freight and particularly installation. This looms important when we measure an electrician's time at 6¢ a minute,

Another claimed benefit for aluminum is the lower voltage drop, because it is nonmagnetic and not subject to magnetically induced energy losses.

Then there is aluminum's excellent corrosion resistance, especially in salt spray or acidic atmospheres. Aluminum can be buried in concrete, or directly in soils; although for full protection an inert, organic coating should be applied. Finally, aluminum conduit is easier to bend and easier to thread.

THE STEEL SIDE OF THE STORY

Steel conduit has served the basic requirements of electrical raceway systems for over 50 years. Thus, "familiarity" is in its favor among manufacturers, distributors and contractors.

Steel conduit is admittedly heavier than aluminum; but as we see it, theoretical savings in installation and handling of aluminum conduit may not materialize—at least not as fully as anticipated. It is doubtful that many more feet of aluminum will be installed in a day's work despite the lighter weight. In the smaller sizes, steel conduit can be handled easily by one man. In the larger sizes, two men will be required no matter what the material. As a matter of fact, the weight of cables in aluminum conduit will require more hangers—rather than fewer—to prevent sagging.

Aluminum conduit will be more difficult to thread than steel in the field, requiring sharper dies and more care to avoid damage. Threads won't cut faster since threading machines all operate at a standard speed.

It is true that aluminum conduit requires less strength to bend, but we doubt whether a man will actually make more bends during a working day. As for aluminum's nonmagnetic, nonsparking qualities, how often are these features really necessary?

Now let's look at corrosion. The various finishes developed for steel conduit through the years have proven most adequate. (All Pittsburgh Standard hotdip galvanized conduit has hot-dip galvanized threads and is zinc chromate coated for an even longer protective life.) There are conditions where aluminum will outlast steel, but there are as many examples where steel will outlast aluminum. In fact, many municipal building codes absolutely prohibit imbedding of aluminum conduit in concrete or in ground.

Steel conduit is stronger, without question, and far better able to withstand abuse—important, for conduit receives rough treatment from the time it leaves the manufacturer's plant until it is installed. There will be much less steel conduit damaged than aluminum.

CONCLUSION

Sooner or later aluminum conduit will find its definite place in the electrical raceway field—being preferred for specialized jobs. where weight and unusual corrosion problems exist. Rigid steel conduit will remain the workhorse for most raceway construction, while EMT will continue to be preferred for lighter construction.

During this evolution it is essential that manufacturers, distributors, contractors, utilities, architects, and consulting engineers learn everything that is to be known on the relative merits of aluminum and steel conduit so that they can make the proper recommendation to the final user or owner.

The above comments are from an address by R. G. McIlroy, president of Pittsburgh Standard Conduit Company. Copies of the complete address will be sent upon request. Write to Sales Department, Pittsburgh Standard Conduit Company, Verona, Pennsylvania.



RIGID STEEL CONDUIT • RIGID ALUMINUM CONDUIT EMT • ELBOWS • COUPLINGS • FITTINGS

PLANTS AT VERONA AND MORRISVILLE, PA.

Electrical Growth 60's

Analysis of national economy trends and electrical industry growth patterns points to unprecedented electrical expansion in the decade ahead. Graphic presentation of these data, specifically selected and prepared for your guidance, are provided to help you plan your 1960 and long range objectives.

By Berlon C. Cooper

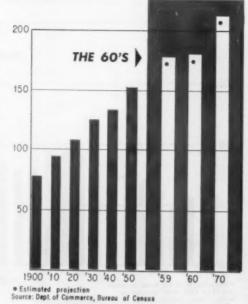
THE NATIONAL ECONOMY

During the next decade . . .

Population increase will total about 35 million
U. S. POPULATION

(Total population residing in US.)

Year											F	0	pulation
1900		*		*	*	ĸ							76,094
1905	*	8.			×	×	×					×	83,820
1910		*	×	×	*		×				×		92,407
1915		*		×	*	×		*	×	×	×		100,549
1920		*	×	×	×	×							106,466
1925		*	×		*		*		×	×		×	115,832
1930		*	×	×	*	*	8			4			123,188
1935			6	8	×					8			127,362
1940		8			*					×	E	×	132,122
1945		4	*	8	×				,	,		*	139,928
1950		ß.	×		×				*				151,683
1951			*							*	*		154,360
1952				*	×			*	×	8	*		157,028
1953			*	×							*	,	159,636
1954		*	×	*			*	,	*			*	162,417
1955	*	š			*	×			×				165,270
1956	*	*	*							6		×	168,174
1957	×	*		*	*			×			×		171,229
1958													174,589
1959			0				×		,	*	8	8	176,350*
1960													180,126*
1970		*									×		213,810*



THE electrical industry outlook is for unprecedented growth and expansion in the decade ahead. In fact, the long-term projected rate of growth for certain segments of the electrical industry, such as electronics and electric energy sales, tops the list of rates of growth now projected for most other industries. Thus, if this optimistic outlook materializes, which now seems not only possible but also probable, the 1960's may well become known, and nationally recognized, as The Electrical Decade.

This optimistic outlook assumes two basic conditions: 1) a continuing economic expansion; and 2) continued progress in electrical technology, research and development, and market promotion.

This special report is based on statistics covering the national economy and the electrical industry, and selected because of their direct or indirect relationship to electrical progress and electrical industry growth. These statistics and data are presented in charts and tables specifically designed to show clearly both current and long range trends.

National economy growth will total 30%

(In Constant 1958 Dollars)

(Billions of Dollars)



1955

● EC&M estimate nerce Office of Source: Dept of Come Business Economics

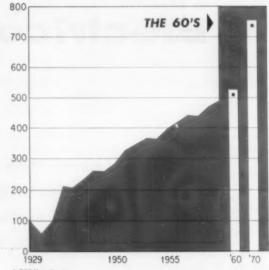
1950

1929

600

Or about 60% in "Current Dollars"

(Current Dollars) (Billions of Dollars)



ECBM estimate
Source: Dept of Commerce, Office of
Business Economics

The status of the national economy determines the business climate in which the electrical industry must operate. Economic growth is thus a vital and controlling factor in electrical industry growth. For this reason, the first part of this 16-page special report is devoted to a searching analysis of factors affecting the nation's economy, and its potential growth rate during the next ten years. The second part of the report is devoted to the electrical industry, and to growth rates, market potentials, and other factors of some of its major segments.

It is not intended to infer, through publication of this report at this time, that there is a relationship between economic growth periods, business cycles, etc., and time as measured in decades. It merely seems timely, as we change from one decade to another, to try to determine where we are headed over the next 10-year period. The long range target date is therefore 1970, and the close-up look is for 1960. As 1959 draws to a close. there will be a barrage of predictions and forecasts, with most of them related to the Sixties.

Also, it is not intended that this report be considered as a forecast. The statistics have been collected,

and are presented for the convenience and use of those who are planning their objectives for next year and for the future. Some conclusions are made, based on specific

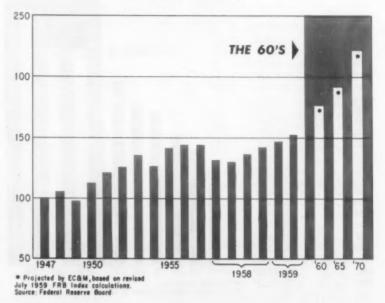
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assumptions. Each individual using these data may make his own assumptions and draw his own conclusions, based on his experiences and trends indicated herein.

Industrial output will continue to climb.

INDUSTRIAL PRODUCTION

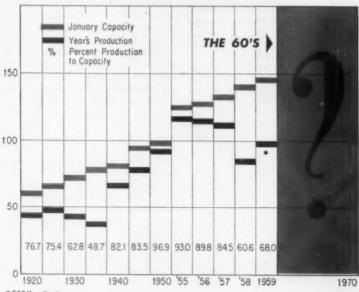
(FRR Index 1947.49-100)



Upturn in steel production is assured.

STEEL CAPACITY AND PRODUCTION

(Thousands of short tons)



*ECAM estimate
Source: American Iron & Steel Institute

1965*.....

1970*

75,000

80,000

There will be more workers. EMPLOYMENT AND UNEMPLOYMENT

(Based on Total Civilian Labor Force) (Thousands of Emplo

(pasea	ed on Total Civilian Labor Porce)		(Inousands of Employees)		
Year	Total	Employed	Unemployed	Per-cent unemployed	
1929	49,180	47 .630	1,550	3.2	
1930	49,820	45,480	4,340	8.7	
1931	50,420	42,400	8,020	15.9	
1932	51,000	38,940	12,060	23.6	
1933	51,590	38,760	12,830	24.9	
1934	52,230	40,890	11,340	21.7	
1935	52,870	42,260	10,610	20.1	
1936	53,440	44,410	9,030	16.9	
1937	54,000	46,300	7,700	14.3	
1938	54,610	44,220		19.0	
1030		45,750	10,390		
1939	55,230		9,480	17.2	
1940	55,640	47,520	8,120	14.6	
1941	55,910	50,350	5,560	9.9	
1942	56,410	53,750	2,660	4.7	
1943	55,540	54,470	1,070	1.9	
1944	54,630	53,960	670	1.2	
1945	53,860	52,820	1,040	1.9	
1946	57,520	52,250	2,270	3.9	
1947	60,168	58,027	2,142	3.6	
1948	61,442	59,378	2,064	3.4	
1949	62,105	58,710	3,395	5.5	
1950	63,099	59,957	3,142	5.0	
1951	62,884	61,005	1,879	3.0	
1952	62,966	61,293	1,673	2.7	
1953	63,815	62,213	1,602	2.5	
1954	64,468	61,238	3,230	5.0	
1955	65,847	63,193	2,654	4.0	
1956	67,530	64,979	2,551	3.8	
1957	67,946	65,011	2,936	4.3	
1958	68,647	63,966	4,681	6.8	
1959*	69,500				
1960*	71.000				

*EC&M estimates, based on interpretation of trends. Source: Bureau of Labor Statistics, Dept. of Labor.

Needless to say, certain broad assumptions must be made with respect to the nation's future economy. These include: 1) there will be no all-out war: 2) the cold war will be contained within reasonable limits: 3) inflation will not increase materially: 4) a deep depression will not occur. With respect to allout war, the current thinking is: that it will be (in fact, must be) : avoided. Similarly, the nation's foreign policy and military program seem to be adequate to meet . the demands that may be made with . respect to cold war or will be altered as required. It is also generally believed that Congress, with pressure from the public, if necessary, will take necessary steps to prevent runaway inflation. A real danger, however, may still be "creeping" inflation. As for a deep depression, most economists seem to believe that existing built-in stabilizers will prevent this, although there is still the possibility of recessions and economic adjustments, and growth rates of boom proportions over limited periods of time.

New Economic Tempo

The U.S. economy faces, first of all, a population growth of some 30 to 35 million by 1970, depending to considerable extent on what happens to the birth rate during this period. Bureau of Census has predicted a total population of 213,-810,000 by 1970, or a 21% increase over mid-1959. Impact of this growth, which is probably conservatively estimated, will be two-fold: 1) it will increase the market potential for goods and services; but 2) it will also increase a) the burden of taxation for schools, colleges. police protection, etc., b) the labor force, etc.—creating new demands for spending.

American economic growth is measured by the total output of goods and services, or gross national product (GNP). The output this year will probably total about \$480 billion (unless the steel strike continues appreciably beyond mid-September), and well over \$500 billion in 1960, measured in current dollars. On this same basis, and assuming a continuing healthy business climate, the next decade will see a growth of about 50%, to around \$750 billion. But when measured in 1958 (or constant) dollars the total GNP by 1970 would total considerably less. This would

Workers will make more money, pay more taxes . . . PERSONAL INCOME, TAXES, AND SAVINGS

(Millions of Dollars)*

	Personal	Tax	es	Disposable	Personal
Year	Income	Federal	State	Personal Income	Savings
1929	85,763	1,263	1,380	83,120	4,168
1933	47,208	474	990	45,744	-648
1940	78,680	1,364	1,240	76,076	4,195
1945	171,222	19,379	1,488	150.355	28.700
1950	228,500	18,179	2,741	207,700	12,600
1954	289,800	29,155	3,799	256,900	18,900
1955	310,200	31,521	4,232	274,400	17,500
1956	330,500	35,110	4,573	290,500	21,100
1957	347,900	37,800	5,000	305,100	20,700
1958	353,400	37,900	5,100	310,500	19,900
1959-1Q	371,800				
2Q	381,000				
1960**	400,000				
1965**	480,000				
1970**	550,000	* * * * * *	****		
* -					

^{*}Current dollars.

represent physical growth. The difference between the two is accounted for by inflation, further devaluation of the dollar, and continuing increases in wages without compensating increases in productivity, which is reflected in rising prices. But regardless of which measure is used (constant or current dollars), the prospect is for rapid economic expansion during the 1960's, bolstered by an increasing rate of production and of consumer buying power.

Industrial output, as measured by the FRB Index, has rebounded from a 1958 recession low of 129 in the 2nd quarter, to 152 in this year's similar quarter (23 points. or 17.8%, in 12 months). Average for 1959 may not go much beyond 152, due in part to the prolonged steel strike. This will serve, however, to boost production next year and the average for 1960 may well exceed 160. The Federal Reserve Board has changed its basis for calculation of the FRB Index since mid-1959, by adding electric power and natural gas output, among other items, to the index. The June index on the old basis of calculation was 155, and on the new basis will be 165. Thus projections in the "Industrial Production" chart shown on page 72 should be increased approximately 6%.

The growth of total production is a function of the labor force, and productivity, or the efficiency with which labor is used in the economy. Productivity of industrial labor increased rapidly while the nation surged forward out of the 1957-58 recession. The postwar rate of increase has averaged a record 3% or more per year. This compares with an estimated increase of 1.5% a year over the past 50 years. Various economists predict productivity growth over the next decade at about 3%, although some think it may be only 2%, and others only 11%. The range of 11% indicated could mean a tremendous difference in the gross national product by 1970, and might easily mean the difference between price stability and an inflationary spiral in the economy.

Consumer demand for goods and services is another potent factor in the economy. It is based to a great extent on total personal income, and how much is left after Federal and State taxes have been deducted. The cushion is, of course, personal savings. The remaining balance is disposable income which is used to purchase goods and services of all kinds. Total personal income has more than doubled since the end of the war, and so have income taxes. But consumers have been spending more than they have been making, and have used credit (both installment and non-installment) to make up the difference (see charts below). Total credit has expanded from \$5.7 billion in 1945 to \$45.1

And spend more for goods and servies . . .

CONSUMER SPENDING

(Billion of Dollars)

		(Sumon or pondry	2	
Year	Durable Goods	Non Durable Goods	Services	Total
1929	9.2	37.7	32.1	79.0
1933	3.5	22.2	20.7	46.4
1940	7.8	37.2	26.9	71.9
1945	8.1	73.2	40.4	121.7
1950	28.6	100.4	65.0	194.0
1954	29.4	120.6	86.6	236.6
1955	35.7	126.0	92.8	254.5
1956	33.9	133.3	99.9	267.1
1957	39.9	138.0	106.5	284.4
1958	36.8	141.9	111.9	290.6
1959*	40.1	145.2	115.1	300.5
1960				
1965				
1970	8111	20000		

Source: Dept. of Commerce, Office of Business Economics.
*First quarter only.

Including time payment purchases.

CONSUMER CREDIT

(Billions of Dollars)

End of Year	Installment Credit	Noninstallment Credit	Total Credit
1940	5.5	2.8	8.3
1945	2.5	3.2	5.7
1950	14.7	6.7	21.4
1951	15.3	7.3	22.6
1952	19.4	8.0	27.4
1953	23.0	8.2	31.2
1954	23.6	8.7	32.3
1955	29.0	9.7	38.7
1956	31.8	10.3	42.1
1957	34.1	10.7	44.8
1958	33.9	11.2	45.1
1959*	34.5	10.5	45.0
1960			
1965			
1970	* * * *		

*End of April 1959.

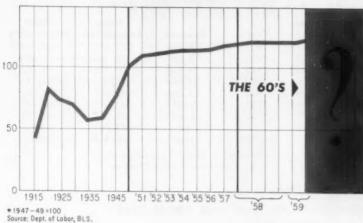
Source: Federal Reserve Board

Source: Dept. of Commerce, Office of Business Economics.

Living costs continue to rise . . .

CONSUMER PRICE INDEX

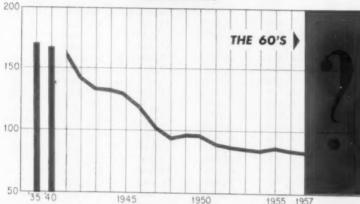
(Cost of Living)



As the value of the dollar decreases.

PURCHASING POWER OF THE DOLLAR

(Consumer Prices)



Higher Taxes and Growing Inflation Reduce . . .

Source: Office of Business Economics Dept. of Commerce.

CONSUMER PURCHASING POWER

(A 20-year record of the two-way "squeeze")

1959 INCOME NECESSARY TO EQUAL 1939 PURCHASING POWER

1939 Gross Income	*Taxes: Income and S. S.	Income After Taxes	Equivalent 1959 Gross Income	*Taxes: Income and S. S.	Lost Purchasing Power	Income After Taxes**
\$1,500	\$15	\$1,485	\$3,256	\$161	\$1,610	\$1,485
3,000	30	2,970	7,035	846	3,219	2,970
5,000	59	4,941	12,113	1,816	5,356	4.941
10,000	269	9,731	25,674	5,395	10,548	9,731
25,000	1,727	23,273	76,860	28,359	25,228	23,273
50,000	6,375	43,625	173,238	82,323	47,290	43,625
100,000	23,116	76,884	388,547	228,321	83,342	76,884

^{*}Federal income and social security taxes are computed for a married couple with two children. No allowance is made for other taxes. Losses from depreciation of the dollar is based on the change in the Consumer Price Index of the Bureau of Labor Statistics.

billion in 1958. Part of this 8-to-1 expansion is due, of course, to the use of credit by retailers to create sales (especially autos, home furnishings, heavy appliances, etc.) in sagging markets after the pent-up demand from World War II restrictions had been met.

Dollar Buys Less

The consumer, however, is not so well off as might at first be expected. It is true that he has more dollars to spend even after his taxes have been paid. But he soon finds that his dollars now buy less. Consider, for example, the necessities of life, which are included in the Dept. of Labor's Cost-of-Living Index (food, shelter, clothing, medical care, transportation, recreation, etc.). This Index, based on 1947-49 = 100, shows that from 1945 to mid-1959 the cost-of-living has risen 62%. In other words, the consumer now has to spend \$162 for the same necessities of life that he paid \$100 for only 14 years ago (see chart, upper left).

This same thing has happened to a varying degree to all of the products and services which the consumer spends his money for. In other words, the purchasing power of the dollar has declined (see chart at left), so that it now takes more dollars to pay for the things he buys.

What this amounts to for the consumer is that he is caught in a two-way "squeeze," as is effectively demonstrated in the table, "Consumer Purchasing Power." His taxes have been pyramiding, while the value

^{**}In 1939 dollars.

Source: Treasury Dept; Bureau of Labor Statistics; National Industrial Conference Board.

Taxes increased 341% from 1942 to 1956 . . . GOVERNMENTAL TAX REVENUE

(Millions of Dollars)

Year	Federal	State	Local	Total
1942	12,270	3,903	4,624	20,797
1945	40,882	4,307	4,886	50,797
1950	35,053	7,930	7,984	50,967
1951	46,031	8,933	8,621	63,585
1952	59,744	9,857	9,466	79,066
1953	62,796	10,552	10,356	83,704
1954	62,409	11,089	10,978	84,476
1955	57,589	11,597	11,886	81,072
1956	65,226	13,375	12,992	91,593

Source: Census Bureau, Dept. of Commerce.

While government spending skyrocketed . . . STATE & LOCAL GOVERNMENT SPENDING

(Millions of Dollars)

Year	Revenue	Direct Expenditure	Debt Outstanding
1922	5,169	5,652	10,109
1932	7,887	8,403	19,205
1942	13,148	10,914	19,706
1950	25,639	27,905	24,115
1954	35,386	36,607	38,931
1955	37,619	40,375	44,267
1956	41,692	43,152	49,161
1957	na	43,761	na
1958	na	48.317p	na

P—Preliminary. Estimated by Tax Foundation. Source: Census Bureau, Dept. of Commerce,

And government debt hit a new high.

FEDERAL GOVERNMENT SPENDING AND GROSS DEBT

(Millions of Dollars)

Fiscal year ending 6/30	Total Federal Expenditures	Major National Security	Vets Services & Benefits	Interest on Public Debt	All other* (incl. agric.)	Gross National Debt
1940	9.062	1,497	552	1,056	5,957	42,968
41	13,262	6,036	566	1,123	5,537	48,961
42	. 34.046	23,936	559	1,272	8,279	72,422
43	79,407	63,159	606	1,825	13,817	136,696
44	95.059	76,846	745	2,623	14,845	201,003
45	98,416	81,309	2,096	3,662	11,349	258,682
46	60.448	43,207	4,416	4,816	8,009	269,422
47	. 39,032	14,372	7,381	5,012	12,265	258,286
48	. 33,069	11,771	6,654	5,248	9,395	252,292
49	. 39.507	12,907	6,726	5,445	14,429	252,770
50	. 39.617	13,009	6,646	5,817	14,144	257,357
51	44.058	22,444	5,342	5,714	10,557	255,222
52	65,408	43,976	4,863	5,934	10,635	259,105
53	74.274	50,363	4,298	6,583	13,030	266,071
54	67,772	46,904	4,256	6,470	10,141	271,260
55	64.570	40,626	4,457	6,438	13,050	274,374
56	66,540	40,641	4,756	6,846	14,296	272,751
57	69,433	43,270	4,793	7,308	14,062	270,527
58	. 71.936	44,142	5,026	7,689	15,078	276,343
59	80,699	46,411	5,198p	7,601p	21,952p	284,706

P-preliminary, as of Jan. 1959.

^eIncludes expenditures for international affairs and finance (including defense support under Mutual Security program), labor and welfare, natural resources, commerce and housing, and general government.

Source: Treasury Dept., and Bureau of the Budget.

of the dollar has been declining. The \$5,000-a-year man of 1939 must today earn \$12,113 to "break even" in terms of purchasing power. The tax "take" for this man was \$59 in 1939; today it is \$1,816. His "lost purchasing power" totals \$5,356. He now works 6 hours out of a 40-hour week just to pay for his Income and Social Security taxes.

Government Spending

Spending by government (Federal, state, local) keeps right on climbing (see tables above). This in turn means that Governmental tax revenues must also rise or fiscal income and expenditures will not

balance. Actually, both of these things are happening.

In the case of the total tax take, in 1942 it was 13% of the total gross national product. In 1956 the total tax (Federal, state, local) was 20.5% of total gross national product.

Total governmental debt outstanding in 1942 was: Federal—\$72.4 billion; state and local—\$19.7 billion (total—\$92.1 billion). By 1956, this had risen to a total of \$322.0 billion (Federal—\$272.8 billion; state and local—\$49.2 billion), or an increase of 250%. At the end of fiscal year 1959 (June 30), the Federal national debt was \$284.7

billion, and interest alone on this debt was \$7.6 billion.

Who pays this tax? The answer is, the "Consumer." And every person is a consumer, from the day he is born. Not all consumers pay income taxes, of course. But every tax—corporate, excise, sales, etc.—direct or indirect, is passed along and paid for by the consumer, in the form of higher prices. This all contributes directly to inflation.

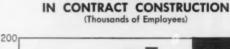
These are some of the factors at work in the economy which affect buying influences and markets for the products and services of the electrical industry at the beginning of the decade of the Sixties.

THE ELECTRICAL INDUSTRY

Electrical construction and maintenance maintains steady growth . . .

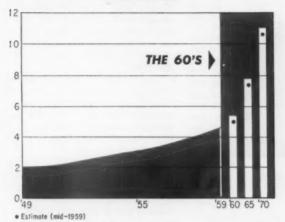
ELECTRICAL WORK IN CONSTRUCTION

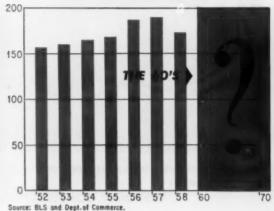
(Millions of Dollars)



Uses nearly 200,000 skilled technicians . . .

ELECTRICAL WORKERS





THE electrical industry as a whole is currently doing an annual volume of approximately \$35 billion, or about 7.3% of the total gross national product. This includes over \$8 billion for the electronics industry, \$13 billion for all other electrical products manufacturing, \$9.2 billion for electric energy sales, and \$4.78 billion for electrical construction and modernization work.

Growth of the national economy through the next decade is expected to total about 50%, which would result in a GNP of approximately \$750 billion in 1970. If the electrical industry growth pattern during the Sixties merely keeps pace with the projected national economy growth, its annual volume in 1970 will total \$55 billion. There are reasons to believe, however, that the electrical industry can and should outpace the economy as a whole in growth over the next ten years. Some of these reasons are presented and discussed in the following pages.

Electrical work in new construction and modernization is continuing its steady climb. Total for 1959 is estimated at \$4.78 billion, or about 8.5% above last year. It is now expected that the increase in 1960 will be about 8.8%, bringing

the total up to \$5.2 billion next year. This is perhaps a conservative estimate, inasmuch as new construction activity is still going strong and in 1960 should rise some 6% to 7%. The conservative estimate for electrical work is due, however, to the expected "mix" in new construction next year. Current trends indicate considerably higher new construction dollar volume for highways, housing, and other types of work which nominally require less electrical work per total construction dollar than is used in industrial, commercial and institutional types of construction, and these are expected to show only slight increases next year over 1959. However, the percentage of electrical work going into building construction generally is continuing to rise, due to an increasing use of electrical utilization devices of all types, and to continuing technological improvements.

Last year saw a decline in the number of electrical workers in contract construction. This decline, amounting to about 7%, was also due to the construction "mix" rather than to the economic recession. While total new construction dollar volume rose slightly, notwithstanding the economic decline, non-residential construction (industrial,

Whose earnings continue to climb

ELECTRICAL WORKERS' HOURS AND EARNINGS

Year	Average Weekly Hours	Average Weekly Earnings	Average Hourly Earnings
1953	39.3	111.61	2.84
1954	38.6	112.71	2.92
1955	39.1	116.52	2.98
1956	39.5	125.22	3.17
1957	39.2	132.10	3.37
1958	38.3	135.97	3.55

Source: Bureau of Labor Statistics, Dept. of Labor.

Construction continues its steady climb . . NEW CONSTRUCTION

(Millions of Dollars-Current Prices)

Year	Residential	Nonresidential	All Other*	Total
1921	2,203	1,946	1,855	6,004
1927	5,320	3,325	3,389	12.034
1933	499	656	1,724	2,879
1938	2,104	1,528	3,348	6,980
1942	2,395	4,445	7,235	14,075
1945	1,280	2,124	2,229	5,633
1950	13,507	6,787	7,608	27,902
1951	13,084	8,649	11,006	32,739
1952	13,496	9,150	12,104	34,750
1953	14,333	10,026	12,759	37,118
1954	15,715	10,886	14,000	39,601
1955	18,971	11,829	13,781	44,581
1956	17,924	12,889	15,247	46,060
1957	17,525	14,059	16,531	48,115
1958	18,716	13,342	16,922	48,980
1959**	21,904	13,370	18,291	53,565
1960*	22,500	14,250	22,000	58,750
1965*	25,000			66,000
1970*	29,000			72,000

^{*}See Chart "1959 New Construction" for "all other" than "Residential" and "Nonresidential".

**EC&M estimate (mid-1959).

Source: BLS and Dept. of Commerce

Currently bolstered by expanding residential and highway work.

1959 NEW CONSTRUCTION

(Millions of Dollars)

Type of Construction	Actual 1958	Estimate* 1959	% Change 1958-59
Total New Construction	48,980	53,565	+ 9
Private Construction	33,947	36,740	+ 8
Residential building	17,884	20,704	+16
New dwelling units	13,405	16,000	+19
Additions and alterations	3,859	4,004	+ 4
Nonhousekeeping	620	700	+13
Nonresidential building	8,720	8,615	- 1
Industrial	2,443	2,000	-18
Office buildings and warehouses	1,986	1,684	-15
Stores, restaurants and garages	1,575	2,016	+28
Other nonresidential building	2,716	2,915	+ 7
Religious	863	945	+10
Educational	567	580	+ 2
Hospital and institutional	610	590	- 3
Social and recreational	424	560	+32
Miscellaneous	252	240	- 5
Farm construction	1,600	1,575	- 1
Public utilities	5,554	5,625	+ 1
Railroad	276	245	-11
Telephone and telegraph	903	750	-17
Other public utilities	4.375	4,360	
All other private	189	221	+17
Public Construction	15,033	16,825	+12
Residential building	832	1,200	+44
Nonresidential building	4,622	4,555	- 2
Industrial	370	375	+ 1
Educational	2,877	2,870	
Hospital and institutional	401	385	- 4
Administrative and service building	530	510	- 4
Other nonresidential building	444	415	- 6
Military facilities	1,235	1,500	+21
Highways	5,350	6,100	+14
Sewer and water systems	1,388	1,463	+ 5
Public service enterprises	450	632	+14
All other public	152	285	+87
*1959 estimate by EC&M (mid-1959).			

^{*1959} estimate by EC&M (mid-1959). Source: Depts. of Commerce and Labor.

commercial, institutional) declined by about \$700 million. This is the area where the highest percentage of the total construction dollar goes into electrical work. Thus, fewer electrical workers were needed to do the available electrical work required. The monthly employment figures for electrical workers in 1959 to date, would indicate a total for this year of about 175,000, or slightly more than for last year. This is still below the number at work in both 1956 and 1957, and indicates that trained labor will still be available for the higher dollar volume of electrical work forecast for 1960.

The number of hours worked per week by electricians has been declining slowly since 1956, when it averaged 39.5 hours for the year. Monthly averages since March 1958 have ranged from a high of 38.7 to a low of 37.2 hours.

Earnings, however, are continuing to climb. The average weekly earnings for March 1959 (latest data available) were \$135.97. Also, average hourly earnings are still on the rise, and were up to \$3.63 per hour in March of this year, compared with \$3.55 per hour average for 1958.

New Construction

The continuing rise in new construction work has been the mainstay of the electrical construction industry since 1945. New construction dollar volume, measured in current dollars, has climbed at an unprecedented rate for 14 consecutive years, from a low of \$5,633 million in 1945 (end of World War II) to a high of \$53.565 million estimated for 1959. This is one of the most spectacular growth rates established by any industry, and has been a major stabilizing influence on the national economy. The 1945 new construction in dollar volume was only 2.6% of the total economy (GPN) in that year, while the 1959 new construction dollar volume will be about 11.2% of this year's total economy. And there is sound reason to believe that new construction activity will continue to rise through the 1960's. However, its rate of growth may be expected to slow down to a rate approximating that of the total economy.

The trends to watch for in new construction activity in the years ahead, from the standpoint of the electrical construction industry, are those of the specific types of construction involved. These will be of more specific interest than the total dollar volume. For example, industrial construction is currently trailing the year-earlier volume by about 18%, and office building and warehouse construction is down from a year ago by 15%. Stores, restaurants, and garages, on the other hand, are up some 28% from the year-ago total. These are the types of construction in which the highest percentages of the total construction dollar go into electrical work.

The table on "New Construction" provides trends for residential, nonresidential, and "all other" types of construction on a long-range basis, with projections on "residential" and "total" for 1960, 1965 and 1970. It is interesting to note that residential construction peaked at slightly less than \$19 billion in 1955, and declined by less \$1.5 billion in 1957 at the beginning of the recession, and has climbed steadily since that time, including through 1958, when the recession hit its lowest point. Yet during all this period home builders were pressuring Congress for better terms for financing and for other assistance.

The table on "1959 New Construction" permits a more detailed analysis of construction trends, for the short-range look, and for planning 1960 objectives. This table indicates that total new construction this year will be about 9% higher than last year. This increase is accounted for primarily by the increases in residential building, military facilities and highway construction. Note that the rate of school construction has not changed. It may actually turn down some in 1960, due to rejection of new school bond issues by votes last fall.

Capital Spending

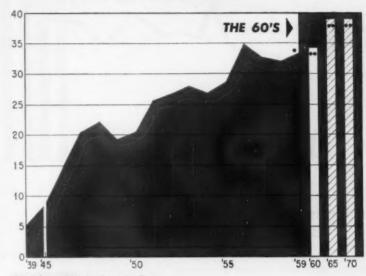
Investment by business in new plant and equipment is considered the key to stability, as well as economic growth, and is a major factor in the continuation of our high standard of living. The quantity and quality of the machines and tools used by workers have a direct influence on the average output per man-hour, or productivity; hence, also on the nation's prosperity.

Capital expenditures turned down in 1957, and declined a little further last year, after increasing steadily since 1945, except for the year of

Industrial expansion renews its climb.

CAPITAL EXPENDITURES

(Billions of Dollars)



 Preliminary estimate, based an seasonally adjusted annual rate through May.
 ◆EC & M estimate. Source: Dept. of Commerce.

BACKLOG OF PROPOSED ENGINEERING CONSTRUCTION

(Thousands of Dollars)

PUBLIC WORKS PROJECTS

Type of Construction	Backlog*
Waterworks	1,781,615
Sewerage	
Bridges	
Earthwork, Irrigation, Drainage	
Streets and Roads	
Buildings	
Unclassified	
Total	49,878,285 11,993,054
PRIVATE PROJECTS	
Bridges	79,639
Industrial Buildings	
Commercial Buildings	
Unclassified	
Total	35,215,248
Total Backlog (Public Works and Private Projects)	85,093,533
*For United States only, as of June 30, 1959.	00,070,000

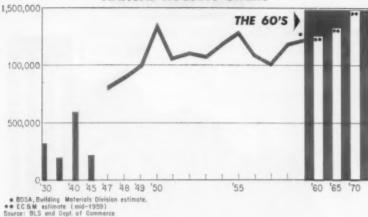
1949, when a slight dip occurred. Outlays have been increasing, however, since last October, and indications are that the increases will continue for some time to come. Hourly rates for manpower continue to climb. Electrical power rates, on the other hand, have declined over the years. An increasing proportion of capital investment must of necessity be spent on new plant and better equipment which

Source: Engineering News-Record.

will effectively utilize electric power, to compensate for the increasing costs of manpower. Thus, the building of new plants, and modernization of older ones, and the installing of modern automated machines and tools must be done, and at an accelerating rate, to meet the growing demand for goods and services at a better price. This fact alone will help to increase electrical industry growth throughout the Sixties.

Homebuilding reflects stable demand . . .

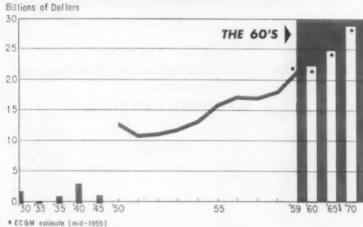
ANNUAL HOUSING STARTS



With increasing annual volume . . .

RESIDENTIAL CONSTRUCTION DOLLAR VOLUME

(In Current Prices)

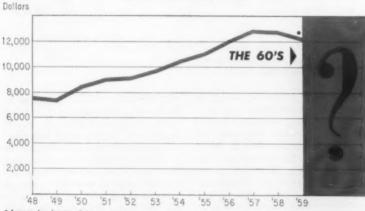


Reflecting higher unit costs.

Source: BLS and Dept. or Con

AVERAGE UNIT CONSTRUCTION COSTS

(New Private 1-Family Houses)



Average for January - February starts.
 Source: BLS, Dept. of Labor

An excellent guidepost to future new construction trends is provided by *Engineering News-Record's* tabulation of this work, given in the table "Backlog of Proposed Engineering Construction."

Homebuilding Renaissance

The next decade should see one of the greatest changes in home-building in history. A major upgrading in housing quality and design is long overdue. Further, with the research and development that is already going into new materials, new construction methods and new utilization devices of all types, a far better house should soon be available, and at a relatively lower price.

The long-range history of homebuilding is shown in the chart (left), "Annual Housing Starts." Based on number of starts annually, 1950 set the all-time record, at 1,-396,000 units.

A more realistic picture of homebuilding growth is revealed by the annual residential construction dollar volume. Homebuilding dollar volume this year is expected to total about \$21 billion, or an increase of approximately 56% over 1950 total dollar volume. This is further reflected in the chart (bottom left) which shows "Average Unit Construction Cost" of new private 1-family houses. For the decade ahead, rising income will undoubtedly create an increasing demand for the construction of new housing, and for modernization of old houses. But new-household formations, and replacement requirements should be easily met with a 15% to 20% increase in new housing units.

The market for housing may be expected to change materially over the next ten years. For one thing, more rental housing will be needed than in the past, which will be met mostly with apartment structures. The demand for private homes will not increase much; in fact, will probably decline.

But the demand will be for better houses and better apartments, or rental units, not only in construction, but in design, space utilization, and equipments. Both home owners and tenants will be demanding "more house per house," and at reasonable prices. For example, air conditioning will be a must, and more and better kitchen and laundry facilities will be demanded.

Electric power output will more than double in the next decade . . .

U. S. ELECTRIC POWER PRODUCTION AND CAPABILITY

Production (Kwhr generated)*	Generating Capability (Thousands of Kw)
81,740	34,600
113,812	37,500
	47,650
282,698	57,300
442,665	95,500
644,760	149,450
763,900	169,700
1,148,800	238,000
1,654,700	337,000
	(Kwhr generated)* 81,740 113,812 217,759 282,698 442,665 644,760 763,900 1,148,800

^{*}Millions of kwhr, including private generation.

Source: Edison Flectric Institute

As industrial operations are further automated.

USE OF ELECTRIC ENERGY BY U. S. WORKER

Year	Kwhr per Worker	Kwhr per Man-hour
1947	11,017	4.95
1948	12,258	5.55
1949	13,185	6.12
1950	14.473	6.61
1951	14,489	6.73
1952	15,575	6.95
1953	17,323	7.16
1954	19,673	7.74
1955	22,913	8.27
1956	24,504	8.67
1957	25,032	9.07
1960*	28,375	
1965*	39,000	
1970*	51,800	

*EC&M estimate.

Source: Edison Electric Institute.

The Electric Power Industry

The United States is today producing about 40% of all the electricity generated in the world, and outranks its nearest competitor. Russia, by three-to-one. Also, U.S. per capita production of electricity is currently about 4500 kwhr per year, or nearly four times Russia's estimated 1200 kwhr per capita per

Existing generating capability of the electric utility industry in the U. S. is approximately 160 million kw, and Electrical World (a McGraw-Hill publication) estimates that this capability will more than

double during the decade of the Sixties (see chart above, left).

Why are the electric utility companies optimistic about future demands for electric power? The answer lies primarily in an analysis of the power needs of a growing economy. In the decade of 1948-1958, electric energy sales rose 263% (see chart above, right), or from 240.7 billion kwhr in 1948, to 567.9 billion kwhr in 1958. Electrical World estimates total electric energy requirements will reach 1,-458 billion kwhr (nearly 12 trillion kwhr) by 1970. This, incidentally, compares with an earlier estimate of 1.298 billion kwhr for 1970 made by the Federal Power Commission in 1957.

The chart below gives the breakdown of total electric energy sales by type of customer. In 1958, residential sales accounted for 28.4% of the total; industrial sales-47.9%; commercial sales - 17.8%; and "other sales"-5.9%. Note that residential sales, as a percentage of the total, have been climbing consistently, whereas industrial sales have remained fairly stable at approximately half of the total sales. This is one indication of the growing importance of residential electrification.

The major market for electric power has, of course, been in industry. The slight decline in industrial sales in 1958 was due in part to the recession, also in part to the growing importance of air conditioning in homes and commercial establishments. Electrical World's forecast is for a further decline in industrial energy use but only as a percentage of total sales. When the tremendous increases in total sales are considered, the rate of growth of electric energy use by industry is still tremendous-from 327 billion kwhr in 1960 to 634 billion kwhr in 1970. or nearly double in ten years.

Another measure of the growing use of electric energy by industry is the "kwhr per worker" shown in chart "Use of Electric Energy by U.S. Workers" (above). Note that this increased from 11,017 kwhr in 1947 to 25,032 kwhr in 1957. More to the point, however, is the in-

The major output will be used by industry. ELECTRIC ENERGY SALES IN U. S. (By Type of Customer)

Year	Resi- dential % Total Sales	Indus- trial % Total Sales	Com- mercial % Total Sales	Other % Total Sales	Total Sales (Billions of Kwhr)
1948	21.2	51.6	17.9	9.3	240.7
1949	23.4	48.6	18.6	9.4	248.5
1950	23.9	49.5	18.0	8.6	280.5
1951	24.2	49.6	18.0	8.2	318.2
1952	25.3	48.9	18.1	7.7	342.5
1953	25.2	49.5	18.0	7.3	384.2
1954	26.4	48.7	17.9	7.0	410.9
1955	25.1	51.8	16.8	6.3	480.9
1956	25.3	52.1	16.6	6.0	529.2
1957	26.4	50.7	17.0	5.9	557.9
1958	28.4	47.9	17.8	5.9	567.9
1960*	28.6	48.3	17.6	5.5	676.8
1965*	30.2	46.5	18.6	4.8	1,014.4
1970*	32.3	43.5	20.0	4.2	1,458.2

1970* *Forecast.

Source: Electrical World

^{**}Electrical World estimate, based on Class 1 Systems.

Modernization of old buildings provides \$26 billion electrical work backlog.

POTENTIALS FOR ELECTRICAL MODERNIZATION

(Millions of Dollars)

Markets	Relighting*	Wiring and Installation**
Industrial	500	4,500
Commercial	3,250	5,500
Institutional	1,250	1,750
Residential	2,500	6,750
Total	7,500	18,500

^{*}Estimated lighting equipment dollar volume, based on manufacturers' selling price.

crease in use of electric energy expressed in "kwhr per man-hour," which can be related directly to productivity increase. In 1947, 4.95 kwhr were used per man-hour, and in 1957, 9.07 kwhr were used per man-hour. The future rate of growth of the national economy will depend in the main on the continuing increase of "kwhr per manhour." Such increase will permit a progressive lowering of unit production costs that can be translated into lower prices.

More than 98% of all occupied homes in America, both urban and rural, are connected for electric service. Many dwelling units, however, such as apartments, are served through one master meter as one electric utility customer, and not as separate customers. Even so, about 85% of all customers served by the electric utilities companies are in the residential classification.

and totals 49 million customers.

The total consumption of electric energy in homes in 1958 was only 28% of the total power sold. But the rate of growth of use of electricity in the home is climbing rapidly, as is shown in the table, "Electric Power Use and Cost In Homes" (below right). In 1958, the average energy used per customer per year was 3,366 kwhr. compared with 1.563 kwhr in 1948. for an increase of 115% in that tenyear period. If this growth trend continues, the home consumer will be using an estimated 7,500 to 8,000 kwhr annuany by 1970. Under the impetus of increasing promotion by EEI as embraced in its National Electric Living Program. this total may well be exceeded.

Although average use of electricity by the home consumer has increased rapidly, the average annual cost per customer has gone up only

about half as fast. The 1958 average annual energy cost was \$85.16, or \$7.10 per month—less than 24 cents a day for the countless services electricity performs in the home. This is due primarily to the spectacular decline of average annual cost per kwhr, which has dropped from 5.52 cents in 1933 to 2.53 cents in 1958.

The electrical industry generally has been looking to new construction activity for its business potential during the postwar years. This is understandable, since new construction has made spectacular strides over the past 14 years.

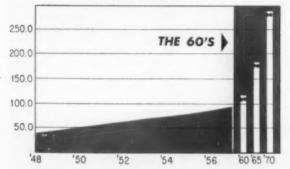
Part of the electrical industry's growth during the next decade, if it is to do the job that needs to be done, must come from modernization. The potential is tremendous for electrical work, some \$26 billion, as indicated by the table above.

Manufacturing companies alone now plan to spend a total of \$24.5 billion on modernization in the four years 1959-1962. This will replace only about 70% of the obsolete facilities that were on hand at the beginning of 1959. This makes no allowance for the additional facilities that will be made obsolete by new machines and new processes introduced during the next four years, and indicates the tremendous job to be done in modernization. When the electrical work potential is also considered for commercial. institutional and residential modernization, and added to the potential growth in new construction activity, the forecast for an \$11 billion electrical work total for 1970 seems ultra-conservative.

Stores and offices are now using more electric power . . .

USE OF ELECTRIC ENERGY BY COMMERCIAL CUSTOMERS

(Billions of Kwhr)



* Retail stores, restaurants, offices, etc.

* Estimated.
Source: Electrical World

But rate of increase is greatest in homes.

ELECTRIC POWER USE AND COST IN HOMES

Year	Average Kwhr Used Per Customer	Average Annual Kwhr Cost	Average Cost per Customer
1933	600	5.52¢	\$33.12
1938	853	4.14	35.31
1943	1,070	3.60	38.52
1948	1,563	3.01	47.05
1953	2,346	2.74	64.28
1958	3,366	2.53	85.16

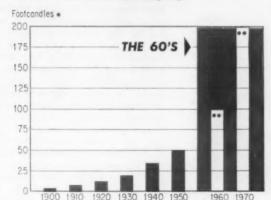
Source: Edison Electric Institute.

^{**}Electrical wiring, rewiring, and installation for relighting, for additional power loads, and for expansion of existing electrical distribution systems, at electrical contractors' selling prices.

People need and are using more light . . .

GROWTH OF ILLUMINATION LEVELS

(For General Interior Lighting)



* Generally accepted as the recommended standard for the years

as indicated.

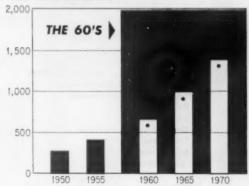
* New IES Recomended Lighting Levels adopted in 1958 range from 30 to 200 Footcondies for visual tasks rated "ordinary" to "difficult". Values shown may be considered "average" for casua visual tasks; much higher levels will be used for more difficult seeing problems.

Requiring more lighting equipment . . .

LIGHTING EQUIPMENT SALES

(Used for General Lighting Purposes)

Value - Millions of Dollars



* EC & M estimate (mid-year 1959)

The Lighting Industry

The design, sale, installation and maintenance of electric lighting are becoming of increasing importance to the electrical industry as a whole. There are many reasons for this growing interest, but the principal one is the increasing impact of this fast growing industry on practically all other segments of the electrical industry. For example, every time a new lighting system is installed, a new wiring system is also required, or an old wiring system has to be modernized. In practice, the new wiring system needed to provide power to the new lighting system costs approximately as much

as the lighting equipment. Both systems have to be installed, involving electrical construction work. Then new light sources have to be installed. And finally, after the new lighting system is turned on, it has to be maintained. This simple procedure for a new lighting system has automatically involved many electrical products, made by a large number of manufacturers and embracing nearly every branch of the electrical industry including the electric utility company which supplies the electric energy used by the lighting system.

The sale of lighting equipment

only, used for general lighting purposes, will this year total an estimated \$575 million, at manufacturers' selling prices. To this may be added another estimated \$410 million, for light sources only (for new installations plus relamping of existing installations). Thus the lighting industry is already doing a volume of approximately a billion dollars annually in sales, not including residential portable lamps, searchlights, automotive, aircraft or railway coach lighting. Christmas tree lamps, photoflash lamps, and miniature lamps used in appliances and for other applications.

Sales of lighting equipment only have more than doubled over the past ten years—up from \$270 million in 1950 to an estimated \$575 million for this year, a nine-year period. If this growth rate continues (there are many valid reasons to believe it will), annual dollar volume by 1970 should reach an estimated \$1.4 billion (See chart above, right).

Sales of incandescent and fluorescent lamps only, used for general lighting purposes, have also nearly doubled over the past nine years (See table at left). Mercury vapor lamps were not included in these data, but sales this year will total about \$14 million, at retail value.

And more lamp bulbs and tubes. GROWTH OF SALES OF LIGHT SOURCES

(Used for General Lighting)

	Incande	scent	Fluore	scent	
Year	Units*	Retail Value**	Units*	Retail Value**	Total Value**
1949	814,401	173.0	72,068	72.7	245.7
1950	933,523	204.6	88,439	95.5	300.1
1951	950,408	228.0	86.652	102.6	330.6
1952	920,825	222.0	77,629	93.0	315.0
1953	976,461	264.0	84,665	121.0	385.0
1954	1,003,600	286.0	86,168	131.0	417.0
1955	1,009,000	300.0	95,000	145.0	445.0
1956	1,100,965	325.0	108,579	175.0	500.0
1957	1,091,800	355.0	109,056	180.0	535.0
1958	1,075,000	360.0	105,000	180.0	540.0

*Thousands

**Millions of dollars.

Lighting Growth Factors

Historically, the generally accepted measure of electric lighting

83

1959 LIGHTING EQUIPMENT DOLLAR VOLUME

(Used for General Lighting Purposes)*

(Thousands of Dollars)

Type of Construction Where Used**	Value
Total New Construction	 500,465
Private Construction	 350,723
Residential (non-farm)	82,816
Nonresidential building	 241,932
Industrial	 52,380
Offices, warehouses and loft buildings	 61,230
Stores, restaurants and garages	 72,576
Other nonresidential building	 55,746
Religious	 20,317
Educational	 12,180
Hospital and institutional	 10,325
Social and recreational	9,324
Miscellaneous	 3,600
Farm construction	 2,361
Public utilities	 13,174
Railroad	 481
Telephone and telegraph	 3,537
Other public utilities	 9,156
All other private	 88
Public Construction	 149,742
Residential building	3,600
Nonresidential building	 96,431
Industrial	 7,050
Educational	 65,341
Hospital and institutional	 6,930
Administrative and service buildings	 10,890
Other nonresidential building	6,220
Military facilities	 4,800
Sewer and water systems	 1,971
Public service enterprises	 1,950
Conservation and development	760
Highways (includes street lighting)	39,800
All other public	 430
Modernization	 75,000
Total Lighting	 575,465

*Does not include searchlights, automotive, aircraft or railway coach lighting, residential portable lamps, and similar types of lighting equipment not associated with building construction.

has been the illumination level, as expressed in footcandles. The chart, "Growth of Illumination Levels," has been selected to illustrate the trend to higher levels of illumination over the past six decades. The footcandle values shown are not specific values that have been historically documented, but rather are average values which are generally accepted within the lighting industry as the recommended standard for the year indicated. Naturally, there were many lighting installations made in 1930, for example, which exceeded the 20 footcandles listed for that date. However, the great majority of installations made at that time were designed to provide 20 footcandles average, maintained in service, and many of the installations made at that time failed to meet even this low recommended value.

Note that for 1960, a value of 100 footcandles is shown as the "generally accepted recommended standard." Actually, it would be more accurate to say that 100 footcandles will be a "generally accepted average" for lighting in office areas and production areas where difficult visual tasks exist. The Recommended Lighting Levels officially adopted by The Illuminating Engineering Society in 1958 vary over a wide range, and cover a wide variety of seeing tasks. Further, these new recommended values represent a minimum lighting level on the seeing task at any time, and no longer refer to "average maintained lighting levels" for an area. Thus the value of 100 footcandles used for 1960, and of 200 footcandles projected for 1970, have been selected arbitrarily to conform with values used up to 1950.

The new IES Recommended Lighting Levels will have a strong impact on lighting practice from now on. These new "standards" have been based on highly sophisticated light and vision research, and for the first time in the history of the lighting industry, on a scientific method of determining how much light is needed to see different types of visual tasks at specific rates of speed. In general, the new values are about double those being recommended previously for similar applications, and are already the subject of considerable controversy. But the fact remains that the basis for determining the new recommendations is valid, and the problems created will gradually be solved and the higher values will eventually be accepted. As a result the "accepted standards" will continue to rise.

Another factor which will affect lighting growth is the continuing growth in efficiencies of light sources. These efficiencies have increased spectacularly since the end of World War II, and expanding research and development may be expected to continue this increase at an accelerating pace.

Also, lighting is now fast becoming recognized by architects and others as an interesting and flexible architectural design element, for both functional and decorative

Industry has already accepted lighting as a production tool, and many industrial plants have already installed lighting systems which exceed even the new IES recommended levels. The relighting of old industrial plants alone will be a potent factor in future lighting growth.

Color in lighting is gradually being recognized as another factor in lighting application, which may be expected to grow at an accelerating pace in the decade ahead.

These factors, and many more, all combine to insure continued lighting progress and an accelerated rate of climb for the lighting industry.

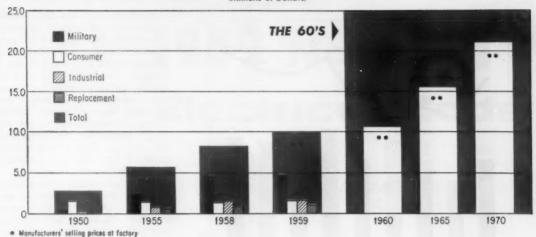
1959 Lighting Volume

The lighting industry this year will do an estimated \$575 million volume, covering lighting equipment only used for general lighting purposes, and based on manufacturers' selling prices. This estimate is based on new building construc-

^{**}Based on EC&M estimate (mid-year) for 1959 Building Construction.

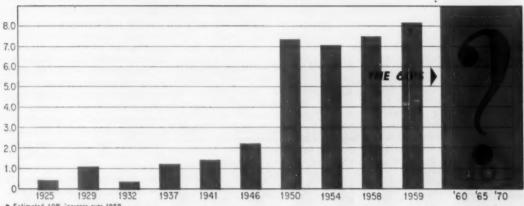
GROWTH OF ELECTRONICS INDUSTRY

(Millions of Dollars)



GROWTH OF ELECTRIC APPLIANCE SALES





* Estimated 10% increase over 1958
Source: Electrical Merchandising - McGraw Hill.

• • Estimated (mid-year 1959)
Source: Electronics magazine-McGraw-Hill

tion which requires lighting, and modernization work. Since the U.S. Department of Commerce did not make a mid-year forecast for total 1959 construction, the construction data for the first 5 months of 1959 were used, and projections made to cover the entire year. These data are shown on page 78, in the table on "1959 New Construction," and were used as the basis for the "1959 Lighting Equipment Dollar Volume" estimate shown in the table on this page (above, left).

Industrial lighting is down sharply from last year's \$82.5 million, due to the drop in industrial construction work. On the other hand, residential lighting is up to \$86.4 million this year, compared with \$67.5 million in 1958. These estimates are for new construction

lighting only, and do not include relighting which is sold on modernization work. As can be seen from these two examples, lighting equipment dollar volume can vary widely, depending upon the building construction "mix," since different types of building construction require varying percentages of total construction costs for lighting equipment. It is pertinent to point out, however, that the trend is to higher percentages of total construction costs for lighting equipment, in all types of construction, as new lighting methods and technological developments are made.

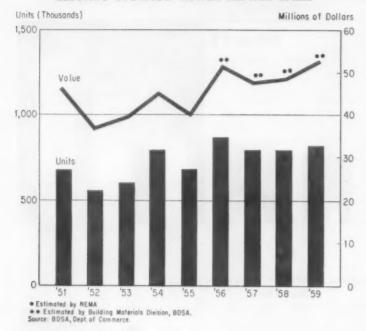
Electronics Industry

The electronics industry is, fundamentally, a highly specialized

branch of the electrical industry. However, because of its rapid expansion since about 1939, and because it is now both big and basic, it is considered one of the nation's leading industries. It is included in this roundup for two reasons; 1) it is the third largest segment of the total electrical industry; and 2) industrial electronics may very well provide the key for the necessary increase in productivity needed to keep the national economy growing in the decade ahead.

Basically, the electronics industry had its beginning about 1925, when radios were introduced commercially. It received its first big push during World War II, when it created and produced radar. Then postwar, it moved upward again with television. Since 1950, it has

ELECTRIC STORAGE WATER HEATER SALES



climbed rapidly with military components related to missiles. Its pattern in 1959 is shown in the chart above showing "Growth of Electronics Industry." By next year, it will have nearly quadrupled in size over the past ten years, and Electronics (a McGraw-Hill publication) estimates that it will double in size during the Sixties.

Industrial electronics currently represents about 17.5% of the total electronics industry. However, its \$1.57 billion volume in 1959 is more than four times its \$376 million volume in 1950.

This year more than half of the industry's total sales are to the Government for military purposes. In the event of peace, or termination of the cold war (certainly a possibility, and to be hoped for at the earliest time possible), the logical electronics market to absorb the army of talent now engaged in military work, which would be released. is the industrial-commercial market. Space explorations would of course continue to provide a sizable market, but great impetus to industrial production could be given through stepped-up "electronification" communications, business machinery, control mechanisms for all industry, scientific instrumentation,

Electrical appliances, radio, TV,

hi-fi, and similar electrical products compete with all other durable goods for sales. And because the market is already saturated on many items, the market is predominantly for replacement, and for the equipping of new homes. Even so, overall sales continue to increase about 5% to 10% annually.

In the decade ahead, it is expected that new frontiers will be established with many more new electrical appliance products to serve the changing needs and wants for a higher standard of electrical living. This will be assured through continuing research and development. Further, it is certainly within the realm of possibility that some spectacular break-through (such as the application of the thermoelectric principle) may be made, which would create a completely new market. In the chart showing "Growth of Electrical Appliance Sales," it is readily apparent that the development of TV. and later of hi-fi, and aided of course by postwar demand for electrical appliances of all types, put appliance sales on a new plateau about 1950, which has been maintained at a nearly constant rate to date. It was, however, the break-through that really helped to establish the new sales plateau.

The Sixties, An Electrical Decade

Short of war, tremendous growth in the electrical industry seems assured in the decade ahead. All signs point in this direction. First of all, a healthy and growing economy is forecast, which will provide a desirable business climate for the entire electrical industry. And secondly, the very growth factors which will contribute to the economic growth of the Sixties will also provide the growth factors needed to push electrical growth to new heights.

Take, for example, construction activity. New construction plus modernization is currently running at about \$75 billion annually, and constitutes a 16% factor in today's total economy. New construction and modernization will play an important role in the economic growth of the next ten years, and continuing growth in this field is predicted. And this construction activity is the very foundation for electrical construction and maintenance work. Continued growth in construction means, at a minimum, the same rate of growth for electrical construc-But advancing electrical technology and expanding electrical utilization holds promise for an even higher growth rate for industrial, commercial, and residential

ent in construction activity.

Consider also the implications of new electrical developments. Many are already here, and are now on the threshold of application and use. Some are in the laboratories under study, and will become available in another few years. But of even greater importance, consider the possibilities of developments that are now in the dream stage.

electrification work than is inher-

Expanding research and development will certainly result in many new electrical developments, devices and products that can have tremendous impact on electrical growth in the years ahead. A spectacular break-through of some type which could very well revolutionize the entire electrical industry is not beyond the realm of possibility in the upcoming Electrical Decade of . . .

60's

1959 National Electrical Code

A discussion of the forthcoming NEC, covering the new format and significant changes and additions in design and installation requirements.

By J. F. McPartland

AJOR revisions in both form and content mark the 1959 edition of the NEC, due to be issued in the fall. Layout revisions include a completely new system of numbering sections within articles, addition and deletion of articles, and reorganization of construction specification and tabular data. Changes in requirements cover such points as: tap conductors on branch circuits supplying

electric ranges, use of 480/277-volt systems, use of grounding receptacles, non-interchangeability of protective devices, an optional method for calculating size of residential services, high-interrupting capacity fuses and current limiting protective devices, unlimited number of conductors in conduit, MI cable in hazardous locations and new types of insulated conductors.

REORGANIZED LAYOUT OF 1959 CODE

1. The introduction to the code is now designated "Article 90" and its several sections are accordingly numbered.

2. The new method of numbering sections within articles uses two-part designations. For instance, the third major subdivision of Article 90 is designated section 90—3. The 15th major subdivision of Article 210 is designated section 210—15. In each such section designation, the first number identifies the article involved and the number after the dash refers to the major subdivision within the article. Subdivisions within sections are still designated by lower case letters, e.g. 240—11(b) or 430—7(c).

3. Article 210 on branch circuits no longer contains the methods of calculations previously given in sections 2115 and 2116. These provisions have been moved to Article 220 which now covers "Branch Circuit and Feeder Calculations." General data on feeders—conductor size, voltage drop, overcurrent protection—are given in new "Arti-

cle 215—Feeders." Old section 2203, which covered sizing of feeders (and service entrance conductors) now is designated section 220—4. This section has been rearranged to afford ready calculation of feeder loads in dwelling occupancies.

4. Old "Article 340—Non-Metallic Waterproof Wiring" has been deleted from the code. Application of this product was very limited. The code-making panel ruled against the practical usefulness of the article,

5. New "Article 402—Fixture Wires" has been added to the code. This article contains spees on fixture wire construction (from Chapter 9, 1956 NEC), current-carrying capacities (from old Table 3, Chapter 10, 1956 NEC) and other data on application of such wires.

6. Article 500 in the new code covers only general data and detailed definitions of the various types of hazardous locations: Classes I, II and III, Divisions 1 and 2. New Article 501 sets forth specific wiring requirements for

all Class 1 locations. New Article 502 covers requirements for Class II locations. And new Article 503 covers Class III locations.

7. Old Article 510 set forth wiring requirements for specific occupancies, or parts of occupancies, which are or may be hazardous locations. Subdivisions of this article covered garages, aircraft hangars, gasoline dispensing and service stations, bulk storage plants, finishing processes and combustible anesthetics. New Article 510 contains only two paragraphs-covering an introduction to following articles on specific hazardous locations. The new articles covering design and installation requirements for such hazardous locations are headed as fol-

Article 511—Commercial Garages, Repair and Storage

Article 512—Residential Storage Garages

Article 513—Aircraft Hangars
Article 514—Gasoline Dispensing and Service Stations
Article 515—Bulk Storage Plants

Article 516—Finishing Processes Article 517—Combustible Anes-

8. Old "Chapter 9-Construction Specifications," as such, has been deleted from the new code. The material contained in this article has been divided among the other articles in accordance with the particular type of equipment. For instance, construction specs on fuses and fuseholders, which used to be sections 92401 to 92408, are now given in sections 240-23 and 240-24 of "Article 240-Overcurrent Protection." Construction specs on conductors are now included in "Article 310-Conductors for General Wiring."

9. Chapter 10 of the 1956 Code

contained 29 tables, three pages of diagrams on locations of overcurrent units for protection of circuits. a motor circuit diagram and examples of code calculations. Chapter 10 of the 1959 Code will contain 10 tables, the same three pages of diagrams on use of overcurrent protective devices and examples of code calculations. Other tables which formerly appeared in Chapter 10 have been placed within the articles to which they properly belong. For instance, old tables 1, 2, 1a and 2a with their notes, covering allowable current-carrying capacities of insulated conductors. are now given as tables 310-12. 310-13, 310-14 and 310-15 in Article 310 on conductors. Tables of motor circuit data—full load currents, maximum ratings or settings of motor branch circuit protection and the familiar Table 20—are now given in Article 430 on motors and controllers.

10. An important section of the 1959 NEC is the "Cross Index to 1956 Edition." This is the last part of the new code and correlates old section numbers with new section numbers. This will greatly facilitate reference by the many users who had become very familiar with code rules according to section numbers. This cross index also correlates tables from old Chapter 10 with tables now in various articles throughout the code. Bold face numbers indicate major changes.

NEW DEFINITIONS CLARIFY MEANINGS

Several new definitions have been added to Article 100 to clarify terms which have been widely misunderstood and misused. Typical of these are the following:

1. Automatic—means self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature or mechanical configuration. Non-Automatic—means that the implied action requires personal intervention for its control.

In the past the term "automatic" has been frequently, but incorrectly applied to motor controllers which operate by electromagnetism but were actuated by operating a pushbutton. Such controllers are not automatic simply because they are

magnetic types. If, however, the operating coil of a magnetic starter was energized by a float switch, time switch, limit switch or some similar pilot device, the control would be automatic. And conversely, the term "non-automatic" has been used incorrectly to mean "manual" when applied to electric controllers. Both magnetic controllers and manual controllers (those in which contact operation is accomplished by hand power) are non-automatic controllers when their operation is accomplished by a person.

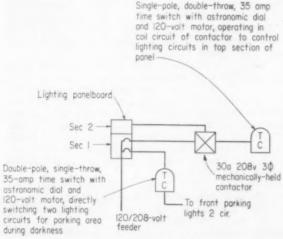
2. Current Limiting Overcurrent Protective Device—is a device which, when interrupting a specified circuit, will consistently limit the short circuit current in that

circuit to a specified magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance.

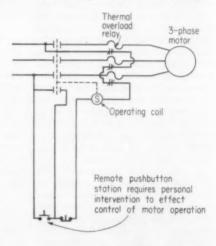
3. Portable Appliance—is an appliance capable of being readily moved where established practice or the conditions of use make it necessary or convenient for it to be detached from its source of current by means of a flexible cord and attachment plug.

4. AC General Use Snap Switch—is a form of general use snap switch suitable only for use on alternating current circuits for controlling the following:

(a) Resistive and inductive loads (including electric discharge



Automatic Control of Lighting By Pre-set Time Clocks



Non-Automatic Control of Motor With Magnetic Starter

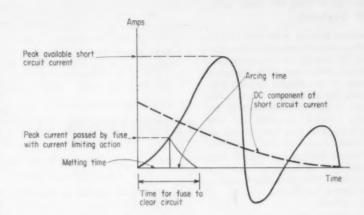
lamps) not exceeding the ampere rating at the voltage involved.

(b) Tungsten filament lamp loads not exceeding the ampere rating at 120 volts.

(c) Motor loads not exceeding 80% of the ampere rating of the switches at the rated voltage. In addition to the electrical rating, such switches are marked "AC."

Other new definitions cover "Cooking Unit, Counter Mounted"; "Feeder"; "Oven, Wall Mounted"; and "AC-DC" General Use Snap Switches."

The illustration at right indicates the current limiting effect of fast fuse operation. Interrupting time includes melting and arcing time.



BRANCH CIRCUIT REQUIREMENTS

Prohibit Tap Reduction for Switch Legs

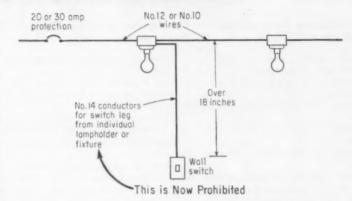
In the 1956 Code, section 2121-c-2 stated that branch circuit tap conductors supplying individual lampholders or fixtures "may be of less capacity than the branch circuit rating provided no tap conductor is of less capacity than the load to be served and the rating is not less than 20 amps for 50-amp circuits or 15 amps for other circuits." This was widely taken as permission for using reduced size tap conductors on switch loops to individual lampholders or fixtures. Section 210-9(c)2(a) of the new code now places a maximum limit of 18 ins. on the length of tap conductors supplying such outlets.

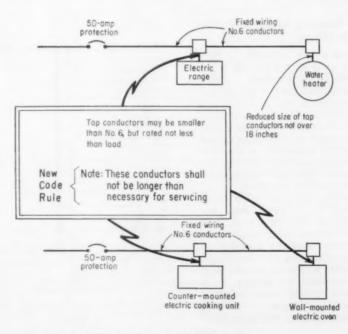
New Rule on Tap Conductors for Range Circuits

To cover installations of electric ranges and separate range components on single 50-amp branch circuits, section 210—9(c)2(d) sets forth the following:

"Tap conductors supplying electric ranges, wall-mounted electric ovens and counter-mounted electric cooking units, from 50-amp branch circuits shall not be longer than necessary for servicing."

This provision now leaves it up to local inspection authorities to rule on the acceptability of the lengths of tap conductors to ranges or range components. The taps are made from multi-outlet 50-amp branch circuits.





Expanded Use of 480/277-Volt Systems

Section 210—6, Exception No. 2, of the new code expands the application of branch circuits rated over 150 but not over 300 volts to ground. Such circuits "which supply only the ballasts for electric discharge lamps in permanently installed fixtures mounted not less than 8 ft from the floor, which do not have manual switch control as an integral part of the fixture" may be used in—

- (1) industrial establishments.
- (2) office buildings,
- (3) schools,
- (4) stores, and
- (5) public and commercial areas of other buildings, such as hotels or transportation terminals (new permissable applications)

Only 30-amp Receptacles on 30-amp Circuits

Section 210—11(b) sets forth the ratings of receptacles when connected to circuits having two or more outlets as follows:

15-amp circuits—15-amp max

20-amp circuits—15- or 20-amp rating

30-amp circuits—only 30-amp

50-amp circuits—50-amp rating Old section 2123 allowed 20- or 30-amp ratings of receptacles on 30-amp circuits.

New Spacing of Receptacles in Dwellings

To eliminate misunderstanding of code rules on the number of receptacle outlets required in dwelling occupancies, section 210—12(b) is a reworded version of old section 2124(b). The increased number of L-shaped combination living-dining areas in residences caused difficulty in application of the 12-ft rule to the boundary between the two rooms. The new section clarifies this question as follows:

"In every kitchen, dining room, breakfast room, living room, parlor, library, den, sun room, recreation room and bedroom, receptacle outlets shall be installed so that no point along the floor line in any usable wall space is more than 6 ft, measured horizontally, from an outlet in that space including any usable wall space 2 ft wide or greater and the wall space occu-

NOW REQUIRED:
Minimum of Two
20-Amp Kitchen
Appliance Circuits

pied by sliding panels in exterior walls. The receptacle outlets shall, insofar as practicable, be spaced equal distances apart."

"Receptacle outlets in floor shall not be counted as part of the required number of receptacle outlets unless located close to the wall."

New Rules on Grounding Receptacles

The basic code requirements on the use of grounding type receptacles in dwelling type occupancies have been expanded in new section 210—12(b), as follows:

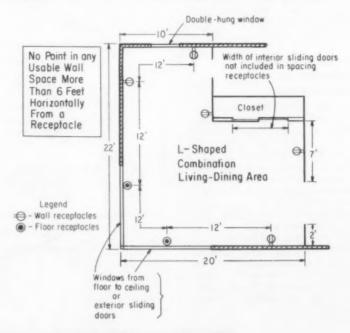
"Where an outlet is installed in the kitchen at the sink location, this outlet shall be of the grounding type."

"Only grounding type outlets shall be installed in laundry rooms, open porches, breezeways, basements, cellars, work shops, garages, on the exterior surfaces of outside walls or in like locations where the outlet may supply equipment used by persons standing on the ground or on grounded conductive materials. These outlets shall be installed in accordance with section 210—7."

Although the 1956 Code made no requirements on the grounding of portable appliances in residential occupancies, the 1959 Code does require such grounding.

Minimum of Two Small Appliance Circuits

New section 220—3(b) requires that at least two 20-amp branch circuits be provided for all receptacle outlets (other than clock outlets) in the kitchen, laundry, pantry, dining-room and breakfast room of a dwelling occupancy. Such circuits may not have other than receptacle outlets in these rooms and may not have outlets in other rooms.



5 Watts/sq ft for Lighting in Office Buildings

The table of minimum unit loads per square foot for general lighting which was in old section 2203 is now table 220—2(a) of new Article 220. The unit loads are the

same with the exception of that for office buildings, which is now 5 watts per sq ft instead of 3. This table is included in section 220—2 which covers calculations of branch circuit loads. Column B of the old table in section 2203 is now given in separate Table 220—4(a) in

section 220—4 which covers calculation of feeder loads. This includes application of various demand factors to various portions of the total branch circuit general lighting load.

The new value for offices is required by higher lighting levels.

FEEDER REQUIREMENTS

Demand Factor Table for Feeders

Column B of the table in old section 2203 is now combined with types of occupancies in an abbreviated table in section 220—4 on feeder calculations, Office building general lighting load is now taken at 100% demand for the total load.

Neutral Load and Electric Discharge Lighting

Section 2203 (g) of the 1956 Code permitted the application of a 70% demand factor to that part of an unbalanced feeder neutral load in excess of 200 amps. But in a balanced 3-phase, 4-wire feeder supplying electric discharge lighting. third harmonic generation by the ballasts produces harmonic neutral currents approximating phase currents in magnitude. Because of this condition, the 1956 Code prohibited reduction of the neutral capacity below that of the phase conductors when the load consisted of 50% or more of electric discharge lamps. Such a rule, however, could be taken to mean that a feeder supplying a load which was 50% fluorescent lighting and 50% 3-phase motors had to have a neutral the same size as the phase conductors-when the motor load had no effect on the neutral at all. The intent of the rule was to assure that a feeder neutral always has capacity equal to the phase load for electric discharge lighting. Of course, the entire matter of harmonic neutral currents does not apply to singlephase, 3-wire feeders, and the 70% demand can be applied to unbalanced neutral load in excess of 200 amps for electric discharge lighting on such circuits.

The new wording at the end of 220—4(d) is: "There shall be no reduction of the neutral capacity for that portion of the load which consists of electric discharge lighting."

75% Demand on Fixed Appliances

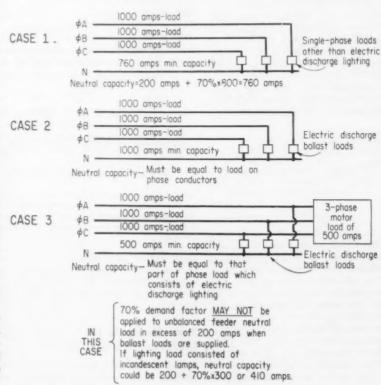
Old section 2203 (e) read: "Where four or more fixed appliances in addition to electric ranges, air conditioning equipment or space heating equipment are connected to the same feeder in a single or multi-family dwelling, a demand factor of 75% may be applied to the fixed appliance load, but not including electric ranges or space heating equipment."

The words "in addition to" gave this rule the effect of permitting use of the demand factor on the total load of four or more fixed appliances only when the feeder also served "electric ranges, air conditioning equipment or space heating." The new code changes the basic intent by simplifying the rule in section 220—4(j). The words "in addition to" are replaced by "other than." The phrase "but not including . . ." has been deleted.

Small Appliance Demand in Dwelling Occupancies

Because two small appliance circuits are now mandatory in dwelling occupancies, section 220—4(h) requires a load of 3000 watts be included in determining the total load on a feeder (or service entrance conductors) for a single-family dwelling, an individual apartment of multi-family dwellings with provisions for cooking or a hotel suite with a pantry.

NEUTRAL CAPACITY- Section 220-4(d)



SERVICE ENTRANCE RULES

New Service Calculation for Residence

New section 220—7 sets forth an optional method of calculating service demand load for a residence. This method may be used instead of the standard method (from new section 220—4, which is generally similar to old section 2203) under the following conditions:

(1) Only for a one-family residence.

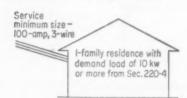
(2) served by a 115/230-volt, 3-wire, 100-amp or larger service, and

(3) where the total load is supplied by one set of service entrance conductors.

This new method was added to recognize the greater diversity attainable in large capacity installations. It therefore permits a smaller size of service entrance for such installations than could be permitted by using the load calculations of section 220—4. The new table of 220—7 is shown in an accompanying illustration with a sample calculation.

Size of Service Entrance Conductors

Section 230—41 makes a new exception to the basic rule that "Service entrance conductors shall not be smaller than No. 6. . . ." Exception No. 1 states "For single-family residences with an *initial load of 10 kw* or more computed in accordance with the code (Section 220—4) the service shall be a minimum of 100 amps. 3-wire."



If the demand on a total connected load, as calculated from section 220—4, is 10 kw or more, a 100-amp service must be used. And if a 100-amp service is used, the demand load may be as high as 23 kw. By using the optional service calculations of Table 220—7, a 23 kw demand load is obtained from a connected load of 42.5 kw. This shows the effect of diversity on large capacity installations.

The above requirement for 100-

Table 220-7 Optional Calculation for One-Family Residence

AD (in kw or kva) Per Cen of Load	LOAD (in kw o
and cooling including heat pump compressors 220-4(f)]	[see Section 220-4(f)] Central electrical space heatin Less than four separately co units [see Section 220-4(f) First 10 kw of all other load.

All other load shall include 1500 watts for each 20 ampere appliance outlet circuit [Section 220-3(b)]; lighting and portable appliances at 3 watts per square foot; all fixed appliances (including electric space heating when there are four or more separately controlled units [see Section 220-4(f)], ranges, wall-mounted ovens and counter-mounted cooking units) at nameplate rated load (kva for motors and other low power-factor loads).

TYPICAL CALCULATION

Given: 1500-sq ft house with all electric utilization.

1500 watts for each of two (minimum of two required) kitchen appliance circuits

1500 sq ft @ 3 watts per sq ft for general lighting and receptacles

14 kw of electric space heating from more than four separately controlled units

12-kw electric range 3-kw water heater

5-kw clothes dryer

3-kw load of unit air conditioners—because this load is less than the space heating load and will not be operated simultaneously with it, no load need be added.

41,500 watts

3,000 watts

4.500 watts

14,000 watts

12,000 watts

3,000 watts

5.000 watts

First 10 kw @ 100% = 10,000 watts

Remainder @ 40%

31,500 x 0.4 = 12,600 watts

22.600 watts demand load

Size of service 22,600 \div 230 = 98 amperes = 100-amp Service

Under certain load conditions, this calculation may arrive at a required service capacity substantially less than 100 amps. In such cases, however, 100 amps is the minimum size service which can be used. When using the alternative calculation method of Section 220–4, it should be noted that a calculated demand load of 10 kw or more requires that the minimum size service be 100 amps, 3-wire. (Section 230–5(a)1)

amp service also carries over to section 230—71 where it states that service equipment in such cases shall have a rating not less than 100 amps.

Bare Neutrals in Underground Services

Section 230-30 makes two exceptions to the basic rule requiring

insulated conductors for underground services:

"Exception No. 1. Uninsulated grounded neutral conductors of aluminum or copper may be installed underground when part of an approved cable assembly."

"Exception No. 2. Bare grounded neutral conductors of copper may be installed underground in duct or conduit."

High-Voltage Service Switchgear

Old section 2389 of the 1956 Code permitted the use of "a non-automatic switch capable of interrupting the rated circuit load and suitable fuses" for the disconnect and protection on circuits rated 25,000 volts or less, when the service equipment was in a vault or was metal-enclosed switchgear. Where the equipment was not in a vault or was not metal-enclosed, only an automatic circuit breaker was permitted.

The new code, in section 230—105, now permits the use of an air load-interrupter switch with suitable fuses, as follows:

 In vault or in metal-enclosed switchgear—on circuits of 25,000 volts or less, provided they are capable of interrupting rated load current.

 Not in vault or in metal-enclosed switchgear—on circuits rated not over 25,000 volts, where mounted on a pole outside the building.

REVISIONS IN OVERCURRENT PROTECTION

General Requirement

General requirements on overcurrent protection of conductors are now given in section 240—5. Two noteworthy parts of this section are the following:

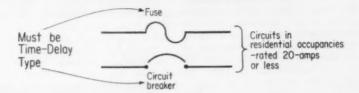
1. "Overcurrent devices installed in residential occupancies on circuits of 20 amps or less shall be of the time delay type." Note that this includes fuses and CB's.

2. "Adjustable-trip circuit breakers... shall be set to operate at not more than 125% of the allowable current-carrying capacity of the conductors." The percentage here used to be 150%.

Section "240—6 Fuses" now lists standard ampere ratings of fuses as follows: 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000 and 6000.

Type S Plug Fuses Now Mandatory

Section 240—21 now requires that Edison-base type plug fuses—0 to 30 amps—to be used only in



holders for type S fuses. The basic rules of type S fuses and holders are presented in section 240—22. However, a note to section 240—21 states that:

"The provisions of Section 240—21 shall become effective on January 1, 1961."

New Requirements On Cartridge Fuses

Section 240-23 includes the following new provisions:

1. Fuses and fuseholders from 601 to 6000 amps, at 600 volts, are classified by capacity.

2. Fuseholders for current-limiting fuses shall not permit insertion of fuses which are not current-limiting.

3. Fuses must be marked with their current interrupting rating if it is greater than 10,000 amps and must be marked for current limiting ability.

Non-Interchangeable Branch Circuit Breakers

Section 240—25 requires that "non-interchangeable circuit breakers used for lighting and appliance branch circuits in residential and other occupancies, except where the conditions of maintenance and supervision assure that overcurrent protective devices and branch circuit wiring will be maintained at proper rating" shall be non-interchangeable on the following basis for breakers up to 250 volts ac and not more than 100 amps:

0- 20 amps

21- 50 amps

51-100 amps

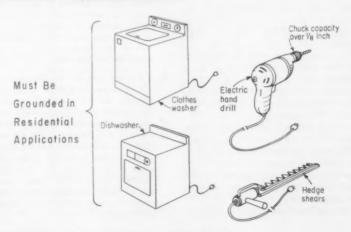
Note: The provisions of this section become effective July 1, 1960.

WIRING REQUIREMENTS

New Grounding Rules for Portable Appliances

Section "250—45 Portable Equipment" now requires grounding of the following appliances in residential occupancies.

- 1. Clothes washers
- 2. Dishwashers
- 3. Portable, hand-held, motor-operated tools and appliances—such as: drills with chuck capacities over 1 in., hedge clippers, lawn mowers, wet scrubbers, sanders and saws. Although the 1956 Code required use of grounding receptacles, portable appliances in homes did not have to be grounded.



New Types of Insulated Conductors

The tables of conductor application and construction now given in section 310—2 list new types of insulated conductors, as follows:

(1) Type THW—This is moisture and heat resistant thermoplastic insulation rated for 75C applications of general circuit wiring in dry and wet locations. It is a plastic insulated version of RHW conductor.

(2) Type SA—This is a conductor using silicon solid dielectric rubber as the insulation, with an outer covering of asbestos or glass. It is rated for 90C applications in dry locations, with a maximum operating temperature of 125C for special applications.

(3) Type TBS—This is a 90C conductor, with thermoplastic and fibrous outer braid for switchboard wiring only.

It should also be noted that type WP conductor has been deleted from the tables.

Unlimited Number of Conductors in Conduit

One of the most noteworthy changes in the new code is the revision of conduit occupancy for general wiring use. In sections 3466 and 3486, the 1956 code prohibited more than nine conductors in one conduit for general wiring. Only special exceptions were made to this rule, as noted in old Table 9 of Chapter 10. Sections 346-6 and 348-6 now permit conduit fills in accordance with new Tables 1 and 2 of Chapter 10. These tables show the maximum numbers of conductors of various sizes which can be used in the various sizes of conduit or tubing. These tables are based on filling the conduit or tubing for new work to the point at which the sum of the cross-section areas of conductors (of the same size) may equal but does not exceed 40% of the cross-section area of the conduit or tubing when four or more conductors are in the conduit. Percentages of conduit fill for less than four conductors are given in new Table 3, Chapter 10.

For installing conductors of different sizes in a given size of conduit, new Tables 3, 4 and 5 are to be used in the same way they were used in the old code, except for the new permission to use any number of conductors.

To conform with this new appli-

TYPE	INSULATION	OUTER COVERING
THW	14-10, 3/64 in. 8-2, 4/64 in. 1-4/0, 5/64 in.	NONE
SA	14-10, 3/64 in. 8-2,*4/64 in. 1-4/0, 5/64 in. 213-500, 6/64 in. 500-1000, 7/64 in.	ASBESTOS OR GLASS

cation of conductors in conduit, Note 8 to Tables 310—12 through 310—15 sets forth the following:

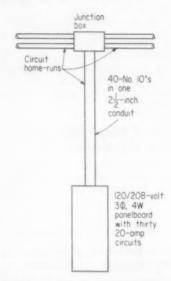
Tables 310—12 and 310—14 give the allowable current-carrying capacities for not more than three conductors in a raceway or cable. Where the number of conductors . . . exceeds three, the allowable current-carrying capacity of each conductor shall be reduced as shown in the following table:

Number of	Percent of
Conductors	Table Values
4 to 6	80
7 to 24	70
25 to 42	60
43 and above	50

From the foregoing, it can be seen that application of large numbers of conductors in single raceways is penalized in copper (or aluminum) usage. And conductors (Continued on page 220)

POSSIBLE APPLICATION OF MORE THAN NINE CONDUCTORS IN A CONDUIT

- Assume a large industrial area, requiring 30 20-amp branch circuits with design loads of about 50% of their capacities. This will consist of 10 3-phase, 4-wire circuits from a 120/208-volt panelboard on a column in the area. To limit voltage drop, No. 10 wires will be used for home runs.
- B. The home runs to the panel are to be made from a junction box mounted near the ceiling of a medium high bay interior. (Of course, the technique of grouping home runs as shown here can be applied to advantage in any type of greg or occupancy.)
- C. The home runs can be installed as 4-No. 10's in each of 10 ¾-inch conduits, as 8- No. 10's in each of 5 1¼-inch conduits (the maximum grouping permitted by the 1956 Code and requiring 80% derating of conductors because of the 6 phase conductors) or as 40-No. 10's in one 2½-inch conduit, as permitted by the 1959 NEC.
- D. In this last case, the No. 10 conductors are no longer rated at 30 amps. Not counting the 10 neutral conductors, there are 30 phase wires in this conduit, requiring, according to Note 8 of Tables 310-12 through 310-15, derating of the allowable current carrying capacity of each No. 10 to 60% of the value given in Table 310-12. The 60% derating value applies when there are 25 to 42 conductors in the conduit. In this case, then, the No. 10's are rated at 30 x 0.6 or 18 amps.



- E. This value of 18 amps is satisfactory for the load of 10 amps on each phase wire. And the 20-amp branch circuit protective devices still satisfy the code on overcurrent protection, being the next larger standard size.
- F. The benefit of No. 10's on voltage drop is the same in any case.
- G. The use of more than nine conductors in this case provides substantial savings in both materials and labor. And the advantages may be extended to grouping home runs in the same direction from the ceiling junction box.

Special Cable Rack Installation

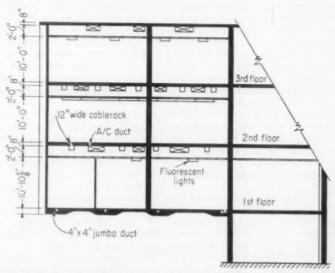
SOLVES CLIENT'S UNUSUAL REQUIREMENTS

Provision of telephone outlets on unusual spacings, to client's specifications, was accomplished by use of special light weight aluminum cable racks.

By Ralph Loeb, Chief Electrical Engineer, Sherlock, Smith and Adams, Inc., Montgomery, Ala.



CABLE RACK of aluminum supports neoprene jacketed cables from terminal box in riser well to four lines of outlets in floor slab on underside of 2nd floor, in B. H. Klein Office Building, Montgomery, Ala. Cables each contain maximum of 52 circuits,



SECTION through building shows location of cable racks with relation to air conditioning ducts, suspended ceilings, and fluorescent luminaires. First floor slab contains 4-by-4-in. jumbo ducts for telephone cable distribution.

PHE B. H. Klein Office Building in Montgomery, Ala., a three story and basement building, was designed specifically for occupancy by the business and administrative office of its client, the Southern Bell Telephone and Telegraph Company in Montgomery. In its general function, this office building is typical of many other office buildings found throughout the country. Southern Bell's electrical requirements were, for the most part, the same as any office building client-50 footcandles of general illumination, a generous number of convenience outlets, numerous lightly loaded circuits, complete air conditioning, and elevators.

Southern Bell had one requirement, however, which was quite definitely unusual. This requirement was to furnish provisions for telephone outlets on 2-ft centers along the entire length of the building, in four rows, on approximately 10-ft centers. The distance between rows varied on each of the building's three floors, and was rigidly set by the telephone company's requirements. It was further stipulated that each outlet used was to be capable of being served by a

52-pair telephone cable.
As is well known within the con-

struction industry, any modern commercial building contains a complex network of pipes, ducts and conduits which are interwoven above the structure's finished ceilings. It is in this furred space between the finished ceiling and the structural floor above that virtually all horizontal runs for the mechanical and electrical services are installed. Because the amount of furred space directly affects each

building's floor-to-floor height, consequently its square foot cost, it is the function of the architect and engineer to hold this depth to a minimum, while allowing sufficient space for all of the mechanical services to be installed. In many cases it is the ingenuity of the engineer which makes it possible for these services to be successfully installed within the space allowed.

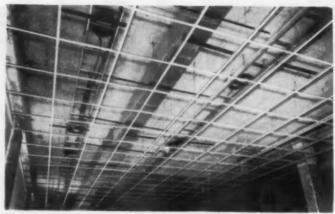
On the B. H. Klein office building project, it was readily apparent that Southern Bell's special requirements for telephone outlets might very well affect the depth of the furred space above the ceilings, and would have to be studied carefully.

In studying this problem, the first consideration was the use of a cellular metal decking (Q-floor) system, which would act both as a structural deck, and as the required electrical raceway system. This possible system was ruled out for two reasons: 1) because the requirements for the locations of the rows of outlets were rigidly set, eliminating the requirement for the extreme flexibility provided by the Q-floor system; and 2) because of the uncertain delivery of steel caused by a nationwide steel strike in effect at the time of design.

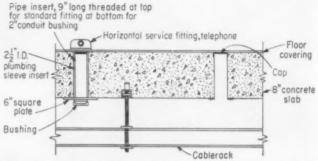
A study by the structural engineers established that a flat slab concrete structure would be the most economical for the owner, and the most rapid to construct. The flat slab system, as the name implies, consists of a reinforced concrete slab of uniform thickness, 8 ins. in this case, with no beams being required anywhere in the design. Because of the absence of beams, the floor-to-floor height of the building was materially reduced.

Although this system was unquestionably the superior solution structurally, it eliminated the second electrical consideration on the upper floors, that is, the use of an underfloor duct system. An underfloor duct system was, however, used on the first floor, which was a slab on grade. This system was a 4in. square "jumbo" duct system, with junction boxes spaced on 20ft centers. Two 2-in. conduit home runs were routed to the telephone chase from each junction to accommodate the large number of 52-pair telephone cables.

On the second and third floors, the telephone outlets problem was solved by the use of light weight aluminum cable racks suspended below the floor slabs. These racks



FRAMEWORK for false ceiling on second floor shows cable rack and telephone cable in place in plenum, and air conditioning ducts. Removable ceiling panel is located 32 ins. below top of third floor slab above. Cables rise through floor slab outlets spaced 24-in, on centers.



OUTLETS for telephones to be used at time of installation were installed as shown in detail at left; outlets provided for future use were capped, as shown in detail at right.

were installed on the centerlines of the required rows of outlets, and were joined by crosses or tee fittings furnished by the rack manufacturer and consequently routed back to the telephone chase. Pipe sleeves $2\frac{1}{2}$ -in. in diameter were installed on 2-ft centers directly above the centerline of the rack. Where the sleeves were scheduled for use upon completion of construction, they were allowed to extend through the slab. All others were capped just below the top of the slab so that the cap could be knocked out, quite simply, from below.

This was the beginning of the final solution. However, as is always the case, many other problems had to be solved before the final design was completed. A furred space of 2 ft 8 ins. was provided to allow space for all the ducts, pipes, conduits, and all of the hangers required for these items and for the ceiling system, plus the alumi-

num cable racks. In order that the cable racks might be accessible at any future time, a lift-out ceiling was specified. This ceiling consisted of 2-ft square tiles on an exposed H- and T-spline system. It is, of course, easily removable and allows instant, simple access to the furred space above.

It was mandatory that the air conditioning ducts, which were installed along the length of the building, be installed so that no part of the duct would occur over the cable rack.

The surface mounted fluorescent luminaires were selected, because of the small furred depth available. It was required that these luminaires be installed so that they would not occur under any ceiling tile which fell directly below the cable rack. Only in this manner would the rack be completely accessible without removing any luminaires. The drawing showing a sec-

tion through the building illustrates how these various relationships were worked out.

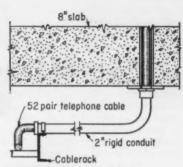
Along the length of the building 12-in. cable racks were installed with 20-in. racks and tees or crosses used for the main run on each floor. A 7-ft wide chase, with a plywood backboard, was provided from the basement to the roof, for vertical routing of the telephone company's cables from each floor to the telephone company's equipment room in the basement.

After the installation of the cable rack and all service fittings were completed by the contractor, the the telephone company's forces in-

stalled the network of 52-pair

The final solution met the established requirements, and proved practical for all concerned, in that it was simple and economical to install, simple, flexible, and economical to maintain, and provided a low first cost to the owner.

Architects and engineers for the B. H. Klein office building were Sherlock, Smith and Adams, Inc., with John P. Shaffer, Jr. serving as design architect and Ralph Loeb as electrical engineer. The general contractor was W. K. Upchurch, and the electrical contractor was Radio Hospital, all of Montgomery.



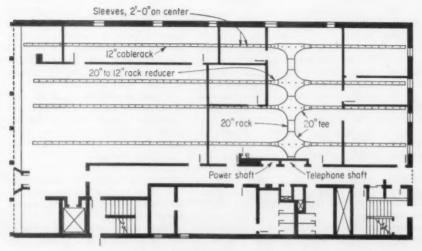
TELEPHONE outlets which were not directly above the cable rack were serviced by 52-pair telephone cable through conduit to offset location as shown by this detail.



FLUORESCENT luminaires provide 50 footcandles maintained in service, were located so they would not fall under the cable rack installation above. Ceiling tile panels lift out, provide simple access to cables at all times.



H. H. KLEIN office building serves as business office for Southern Bell Telephone and Telegraph Co., Montgomery, Ala. The completed building reveals no trace of the mechanical complexity concealed in the suspended ceiling.



LAYOUT of telephone outlets and cable rack installation for a typical floor.

Selling a Cost-Plus Contract

There are no set rules for selling electrical contracts. However, contractors must have valid material to prove they can produce quality installations at reasonable costs. This discussion emphasizes some of the selling points.

By Ray Ashley, Research and Consulting Engineer, Oak Park, Ill.

WCH has been written and said about selling. But most of the discussion has related to such products as cars, homes, clothes, or other items that the buyer can see and generally knows a great deal about.

Selling of electrical installations is a much more difficult subject to present. The "end product" is a carefully engineered combination of component items and devices which exists only in the form of plans or in the mind of the buyer. And more often than not, the buyers have very meager, if any, knowledge about electrical work. Too frequently, this lack of knowledge is bolstered by a set of entrenched opinions regarding contractors and electrical construction operations. Among these are:

1. One contractor is just as good as another.

2. All mechanics possess the same skill and productive ability.

3. National and local codes assure the best type of installations available.

 Tool needs for electrical construction work are of minor importance.

Construction plans supplied by electrical contractors are of little consequence.

6. Job progress and completion date are as well insured by one contractor as by another.

These "mistaken ideas," common to many in the market for electrical installations, are definite sales obstacles that must be hurdled. An important part of a contractor's selling job is to enlighten buyers

on these subjects. One effective way of doing this is outlined in the following pages. The "Cost-Plus" contract was chosen deliberately because it illustrates to better advantage just what a contractor has to sell. The same basic principles can be applied to other type contracts.

Selling the Contract

Let's trace the steps used by an astute contractor in bidding a "Cost-Plus" project and selling himself and his organization to the owner.

I. Request a Bid Interview. The contractor gets an invitation to submit a price for installing electrical work. More than likely, this will be a request to "quote a price." Such invitations generally show that the party knows little about buying electrical installations.

Before figuring the job, the electrical contractor should call the buyer and request that he be allowed to bring his bid and explain it. Buyers usually are surprised by such a request for they can't understand what could be explained about a bid price. Here, the contractor has an educational job to do.

If a substantial contractor has his interview request refused, his chance of getting the contract is slim. A refusal may mean the buyer already has decided on his contractor and is just checking bids; or he will look at nothing except the figures after the dollar sign.

If the interview request is granted, the contractor can do a

real selling job (see Step III).

II. Submit Proper Bid. The language of the bid proposal should be clear and definitive and leave no room for misunderstanding. Contractors must be thoroughly familiar with operating costs (see Sec. III, Electrical Estimating, McGraw-Hill Book Co.) to bid intelligently on Cost-Plus work. Of all the salient points to be considered, that of having a separate markup for material and labor is most important and is illustrated in the following proposals:

Wrong Form

We wish to quote you the following price for installing electrical work in your plant at the above address: All work will be billed at cost plus 20% for overhead and 10% for profits.

What is wrong? While the owner may know nothing about the electrical contracting business, he does know the cost of supplying material for his own business. He looks at the 20% and 10% and concludes, "That is a total markup on material of 32%. It is absurd."

Knowing nothing about the cost of supplying the labor, he considers that also absurd. What is the result? He may do one of three things:

1. Shop for more bids.

2. Decide to buy the materials and let the contractor install them.

3. Hire mechanics, buy the materials and take care of the entire installation.

Right away, someone is going to say, "We bill for 20% plus 10% all

the time." Yes, but how long can you continue to do it with impunity? Besides, our figures are for illustration only. They might have been 40% and 10% for a small project or 10% and 5% for a large project. We must follow our example through.

Countless numbers of good contracts and accounts have been lost due to the common markup of the "20 and 10" type. From the standpoint of the smart buyer, the bid is not good because it does not state how job costs will be billed.

Now, let us study a recommended type of Cost-Plus bid.

Recommended Form

In answer to your request of February 9th, for a bid on electrical work to be installed in your plant, we wish to advise that our standard rates for billing such work are as follows:

MATERIAL. The charges for material, insurances, inspection and other job expenses are cost plus 10% for service and overhead and 5% for service return.

LABOR. The mechanics' time will be billed at cost plus 35% for management services and overhead, and 10% for service return.

The cost of tools, construction engineering, cartage and similar job expenses will be billed as 6% of the payroll. If your contract greatly exceeds \$4,000, you may anticipate more favorable markups.

Again, remember that the above values are for illustration purposes only.

Overhead is a hard thing to sell, so the contractor states that the material markup of 10% is for service and overhead. A similar statement is made regarding the 35% markup on labor.

The contractor may have to explain that the "service" charge is the cost of selecting, purchasing and protecting the materials for the particular job. It is a direct job cost and not overhead.

A low markup for material and a higher markup for labor is used because such figures portray a true proportion. Besides, the percentages inform the buyer that the major cost of electrical construction is the supply and management of labor.

If the buyer sees a reasonable markup on material, he is likely to assume that the markup on labor is also reasonable.

The term "Return" is used instead of profit. If this terminology is questioned, a good answer is, "Return is anticipated profit, but one seldom realizes as much as was included in the estimate."

Such answers impress the owner because he is informed that contractors figure closely.

Note that the 35% is labeled management and overhead. The statement informs the buyer that management is an important factor in the supply of labor for electrical installations.

Contractors frequently are asked how much they charge per hour for labor. The answer is that they charge just what they pay the mechanics. Any charges over and above that amount are for the cost of supporting labor and for service return.

A separate item of cost is included for tools, construction engineering and other job expenses. They are job expense, neither material nor labor, and are useful selling points.

III. Interview Data. There are no fixed rules for selling electrical contracts. Each buyer and each project presents individual problems. One must try to anticipate

the nature and wishes of the customer and the special needs of the work. The program for selling must take shape as the interview progresses.

A contractor enters an interview with a head full of ideas and a brief case full of data, all designed to sell the job. Only one or two items may be used. But, they may be the right ones to close the deal. One thing is sure. A contractor must have data and material to substantiate any statement made.

It's not enough to claim, "I have better tools, better mechanics and better management than my competitors and I should have the contract." As a contractor makes statements, he can present his verifying data. The buyer may not even look at it, but he will know that the contractor is ready to back up his claims.

The buyer is not interested only in what the contractor has. He wants to know what the contractor can do to give him a good installation at a reasonable price.

Having the right data, the right things to say, and knowing the right time to say them are all essential to good selling.

What are some of the substanti-

CREW LIST MEN AVAILABLE FOR

NAME R. Apprentice	R	ATIN	3	AGE	YEARS	YEARS	SPECIAL JOBS
	Journeyman	Foreman		AS AN ELECT.	WITH CO.	WORKED ON	
	+	X		36	10	12	Markham Machine
Fred Barber	-	-			16		77.00.00
Jas. Burn		X		24	3	2	Bristol-Kay
Harry Evans			X	40	19	19	Milford Steel
Wm. Harris		X		21	5	1	Markham Machine
Clem Laine		X		34	14	12	I.I. W. Utility
Al. Meyer	X			18	1	1	Bristol-Kay
Joe Mullett		X		45	27	20	Control Specialist
Albert Stone		X		30	8	4	H. & H. Elect. Prod.

Fig. 1.—LIST OF MECHANICS available for project, with pertinent experience data for each, draws buyer's attention to the important contractor function of selecting good mechanical crews.

JOB	TOOL LIST FOR ELECTRICAL CONSTRUCTION (INTERIOR)						JOB NO				
	No.	Shipped	Returned		Ho.	Shipped	Returned		No.	Shipped	Returned
I,-PIPE TOOLS				III GEN. CONST. TOOLS				IV WIRE INSTALLATION	& CONN.		
BENCHES LARGE				TOOL BOXES-STEEL					1		
BENCHES SMALL				TOOL BOXES - WOOD				FISH TAPES 1/8 IN			
VISES 1/2" TO 2"				LOCKS				FISH TAPES 3/16 IN			
VISES 2" TO 4"				CHAINS-LADDER				LFISH TAPES 1/4 IN			
STOCKS				LADDERS-STEP 6 FT.							
1/2" TO 1"				LADDERS-STEP 8 FT.				WINCHES-HAND DR.			
1 1/4" TO 1 1/2"				LADDERS-STEP 10 FT.				WINCHES-POWER DR.			
2" RATCHET				LADDERS - STEP 12 FT.				POWER DRIVE-UNIVERSAL		1	1
2 1/2" TO 4"				LADDERS-STEP 14 FT.				WIRE ROPE V4 IN			
			-	LADDERS-STEP 16 FT.				WIRE ROPE 3/8 IN			
DIES 1/2"								CABLE PULLERS			
DIES 3/4"	1.			LADDERS-EXTEN.							
DIES H I"				SCAFFOLDING MAT.				REEL JACKS			
DIES DIES 1"								PICK UP CART			
DIES W 11/2"				EMERY WHEELS				BRAKE-CABLE			1
DIES 2"				ELECTRIC DRILLS 1/4 IN.				REELS - PAY-OUT			
DIES 0 21/2"				ELECTRIC DRILLS 1/2 IN.				REELS & STAND			
DIES 2 1/2"				DRILLS-TWIST SIZE					1		
DIES 4"				DRILLS-TWIST SIZE				STRIPPERS - WIRE			
THREAD CUTTER-PR.DR.				TAPS SIZE				GAS FURNACE			
BENDER SMALL				TAPS SIZE				SOLDER POT & LADLE			
BENDER LARGE				WHITNEY PUNCHES				ELECT, SOLDERING SET.			
HICKIES (H.W. COND.) 1/2"				K.O. PUNCHES 1/2" TO 1"		-					
HICKIES (H.W. COND.) 3/4"				K.O. PUNCHES I 1/2" TO 2"				STEEL LETTERING SET			
HICKIES (H.W. COND.) 1"				AIR HAMMERS							
THIN WALL BENDER 1/2"				ELECT. HAMMERS-NO.							
THIN WALL BENDER 3/4"				ELECT. HAMMERS-NO.							

FIG. 2—TOOL LIST highlighting items required for specific project can be used effectively to show the buyer the economic advantages of engaging a fully-equipped contractor.

ating data you, as a contractor, can use to improve your sales position? Calling the buyer's attention to the following may help:

1. Mechanics—Have a tentative list (Fig. 1) of the mechanics available, together with pertinent information (age, years working as a journeyman electrician, status on recent projects, jobs worked on, etc) to show the buyer. Explain that a well selected crew can accomplish 10% to 25% more work than a group selected at random.

The buyer may not bother to look at the list, but he will know you are serious about supplying good mechanics. It will also start him thinking that there can be a difference in the productivity of mechanical crews.

2. Tools—A list of the tools (Fig. 2) that you propose to furnish for the work can be impressive. Figures showing the savings possible through job mechanization can have a substantial impact.

Buyers are often surprised to learn of the number and the cost of the tools that can be utilized effectively on electrical construction projects. But few, if any, have given any thought to the fact that tools can affect the final cost of the work.

3. Manpower Support-Explain

how essential it is for the men in the field to be supported with good construction drawings, good supervision, and adequate tools. Sample drawings from previous jobs may be used to an advantage. Timely delivery of materials is another important factor.

This must be brought to the buyer's attention. He should understand that from the time the work starts until it is completed, the entire contractor's organization must be backing up the men in the field.

However, don't overdo the sales talk and do avoid boring the cus-

4. Completion Date—This term provides a very effective wedge for selling. Buyers may focus attention on the electrical installation price and neglect to estimate the cost of delayed completion. Large investments in machinery, equipment and buildings may await start of production. Back orders or new product lines may compound the cost of delayed completion. Such losses of sales and product revenue may easily dwarf any saving in electrical installation based solely

An estimate of what construction and installation delays can cost the buyers in hard dollars is an effective convincer. Such an item just is not overlooked in selling a guaranteed completion date electrical contract.

5. Previous Contracts—At times it may be advisable to supply buyers with a list of completed or near-completed projects. The buyer may see familiar names and exhibit increased confidence in your firm.

6. The Dollar Sign—The dollar sign is a hard thing to outsell. Be prepared with figures that show economies can be effected by engaging competent contractors who, through proper job control, can produce the following anticipated savings:

Selecting the better me-	
chanics	10%
Use of adequate tools	2%
Proper choice and timely de-	
livery of materials	5%
Well executed construction	
drawings	5%
Careful overall management	3%

Total savings 25% Keep figures like this at hand. There is always a question as to how impressive they may be. One thing is certain. The owner will realize that you have his interests in mind.

IV.—The Competition. A contractor must always anticipate his competition. Chances are very good

that, in a group of bids, there will be one or more quoting the much used markup of 10% and 10%. Be prepared for this. Be able to assure the buyer that such a bid may have no bargain to offer.

One way of doing this is to have two estimate recaps (as illustrated) prepared showing the billing prices per \$100 base cost for a contract with a 60/40 (60% material and 40% labor) M/L ratio. For one estimate use your own markups. For the other use the 10% and 10%, as comparison. Point out the difference.

Estimate II (the 10% and 10% markup) shows an excess cost of \$12.00 or 12% of base cost, over Estimate I. Unless he is shown, the buyer has no means of knowing that a saving can be made by hiring the better contractor. Neither has he any assurance that the premium he will pay for the "apparent" low bid will not be greater than indicated. However, the figures should convince him that low markups on cost-plus contracts do not necessarily guarantee low completed job costs.

Close The Sale

If you, the contractor, are successful and are promised the contract, conclude the bid interview and leave before you talk yourself out of the job or the buyer changes his mind. Go directly to your office and write a letter telling the customer that you are proceeding with the work in accordance with verbal instructions.

The customer may write a formal order before you leave his office, but that is doubtful. In the author's years of experience, he has never been given such an order. Buyers consider verbal orders sufficient for starting the work because the contractor's proposal serves as a record of contract terms.

In the electrical contracting business, opportunities for selling anything besides a low bid do not come often. When they do, the contractor must be prepared to make the best of the situation. Each worthwhile sale may pave the way for good future business.

Most anyone can get contracts, per se. But it is the astute manager who selects the better work, takes the time to sell his organization and get the business with a profit. As

COMPARATIVE ESTIMATE RECAPS PER \$100 BASE COST ON A 60/40 M/L RATIO JOB

ESTIMATE I—Using markups of 10% and 5% on material; 35% and 10% on labor.

011 14301.	Material		Labor
Base Costs	\$60.00		\$40.00
Insurances, Labor—10% of 40.	4.00		_
Inspection	2.00		-
	66.00		40.00
Service and overhead 10%	6.60	35%	14.00
	72.60		54.00
Direct job costs (tools, etc.)	Incl.	6% of 40	2.40
Total Costs	72.60		56.40
Service return 5%	3.63	10%	5.64
Billing price—Material	76.23		\$62.04
Billing price—Labor	62.04		
Billing price—The Job	\$138.27		

ESTIMATE II—Using the common markup of 10% for overhead and 10% for profit.

Promi	Lab. & Mat.
Base Cost of Material (normal)	\$60.00
Material Waste (poor selection and carelessness)	1.20
Base Labor Cost (normal)	40.00
Excess labor due to poor management25%	10.00
Total Job Cost—Material and Labor	111.20
Tools	3.00
Cartage and misc	3.00
Inspection	2.00
Insurances—labor (10% of \$50.)	5.00
Total Cost	124.20
Overhead	12.42
	136.62
Profit10%	13.66
Bid Price per \$100. base cost	\$150.28
Billing price per \$100. base cost—Est. II	\$150.28
Billing price per \$100. base cost—Est. I	138.27
Excess Cost of Estimate II	\$12.01

ESTIMATE RECAPS clarifying markups on material and labor have been used advantageously to promote contractor sales. They emphasize the contractor's prime function of supplying and managing labor; help discourage direct purchase of materials; show that low percentage markups do not always insure low job costs.

indicated herein, the electrical contractor has much more to sell than just price. The ideas presented can be and have been used successfully. It may take a little more preparation, but selling never is easy and

the extra effort is well worth while. Remember, every quotation presented, every job installed, every bill mailed can affect the sale of a contractor's services—currently or at some future date.

Electric Heat Cuts Modernization Costs

How an apartment-building owner saved 57% by installing electric heat.

ONVERTING an old brownstone apartment-house into a modern, up-to-date unit can be very costly. This is especially true when renovating plans call for installation of a modern heating system, plus air conditioning. But here is a job where the owner of such a building saved 57% of the cost originally figured for heating and air conditioning. The case in point is a 6-unit. 3-story apartmenthouse located on Chicago's near north side in a section of the city called "Old Town." Each of the six remodeled apartments contain two bedrooms, a combination living room-dinette area, a kitchen and a bathroom.

The cost of installing conventional heating and a chilled water air conditioning system in the 6-unit building was estimated at \$11,-700. Actual cost of installing radiant electric baseboard heating and individual 1-ton (through the wall air conditioners) was less than \$5000. This represents a savings of \$6,700, or 57% of the original

heating and cooling estimate.

The owner, besides being very pleased with the opportunity to save money at a time when most construction costs are on the rise had this to say about the electric heating job. "Using electric heat as a talking point, I rented my remodeled 'Old Town' apartments to the first or second prospect." For example, when prospective tenants were told that electric heating would provide the exact temperature desired for each room without affecting the temperature of any other room-operating costs were no obstacle. The apartments (as will be shown later on in the article) are individually metered; the tenant pays his own electric bill, rate is 12 cents per kilowatt hour.

Now that we know the basic advantages of electric heat as it is installed in this remodeled apartment building, let's review a few of the more important design considerations. The electric heating design calculations were developed for the building by the Common-

wealth Edison Co., (Chicago utility) in cooperation with the Principle Electric Co., contractors who installed the electrical work. The following installation schedule lists the wattages and locations of the various radiant baseboard heaters employed throughout the apartment: One 2000-watt baseboard unit is installed in each of the combination living room-dinette areas; 1000-watt baseboard units are installed in each of the bedrooms, and 500-watt units are located in the bathrooms. A 1000watt baseboard unit is mounted in the building's first floor utility room. This room besides containing the service entrance equipment, individual apartment meters, house meter and each apartment's breaker panel, has an electric powered clothes dryer and washer for convenience of the tenants.

Insulation requirements forth in the original design calculations dictated installation of 6 ins. of insulation (wall batts) in the ceilings, and 4 ins. of insulation (wall batts) in the walls. In addition to the 4 ins. of insulation, the inside walls were covered with a membrane of polyethylene film. The polyethylene membrane serves as a vapor barrier to prevent moisture from collecting between the walls. The insulation pays for itself-in comfort and cash. It keeps both heating and cooling costs economical for the tenants while providing them with a warm and draft-free apartment in the winter and a cooler and cleaner apartment during the summer. Another hidden advantage of the extra heavy insulation is that it hushes street and outside noises. Also, because of the extra amounts of insulation, it is estimated that the cost of air conditioning will be less since the apartments will seldom become uncomfortable, even in hot weather; and, once the apartments are cooled they will stay cool longer. These





BEFORE AND AFTER view of exterior illustrates the extent of the modernization program that converted an old 3-story brownstone apartment in Chicago's near north side to a model of modern up-to-date efficiency. Air conditioning and radiant electric heating were important phases of the remodeling job.



NEW SERVICE ENTRANCE for remodeled 3-story, 6-unit, electrically heated apartment building is 600-amp, 110/220-volt, 3-wire, single phase.



CONTRACTOR Joseph Kunst, Jr. of Principle Electric Company is pictured with the 600-amp main entrance switch his company installed as part of an All-Electric apartment remodeling job. The completely rejuvenated brownstone apartment building features electric heating, electric cooking, electric water heating, electrically operated laundry equipment and air conditioning.



INDIVIDUAL LOAD CENTERS, plus meters for each apartment, including house meter are ganged in building's utility room. Tapoffs to meters are made from feeders run in a 6-in. by 6-in. wireway that connects to bottom of main disconnect switch.



COMPLETE COMFORT CONTROL is provided by separate thermostats in each room. Apartment owner pictured above explained this advantage to prospective tenants and found once they understood these benefits, operating costs were no obstacle.



INSULATION was an important phase of the electric heat installation. In addition to installing 4 ins. of insulation, the inside walls were covered with a membrane of polyethylene film. Besides preventing moisture from getting between walls, heating and cooling costs are less.



BUILDING OWNER John Clayton points to one of the radiant electric heating units installed in his newly remodeled apartment building. Clayton, using electric heat as a talking point, rented his modernized "Old Town" apartments to the first or second prospect.

above factors were all taken into consideration when determining the size of the air conditioners needed to cool the apartments.

One-ton, window-type air conditioners were chosen to meet each apartment's cooling requirements. The units are mounted through the front wall of the building, directly beneath living room windows. So the units would not detract from the newly remodeled exterior, the outside grill of the air conditioners are flush mounted in the building's facing.

A humidistat installed in each kitchen automatically turns on kitchen exhaust fan when moisture accumulates. All bathrooms also have exhaust fans to control mois-

ture, although the bath-fans are controlled manually from singlepole toggle switches.

In addition to the electric heating and air conditioning, electricity serves the building's cooking and water heating requirements. Tenants also have discovered plenty of electrical capacity to power such household items as vacuum, floor polisher, mixer blender, lamps, radios, TV sets, and record players.

Principle Electric, by installing a 600-amp, 110/220-volt, single-phase, 3-wire service entrance assured the owner that adequate power would be available for all the building's electrical needs for now and in the future. A 600-amp main disconnect mounted in first floor

utility room feeds individual apartment meters, plus a house meter. 20-circuit, 100-amp multi-breaker panels are installed directly above each meter. Circuit distribution to each of the six apartments are carried from these panels by runs of 1, 1 and 1-in. EMT. Circuit breaker arrangement for a typical apartment's distribution is as follows: Two 220-volt, dp breakers for heating; one 220-volt, dp breaker for air conditioning: one 220-volt, dp breaker for cooking; one 220-volt, dp breaker for water heating; and one 220-volt, dp breaker serves as a main for two 110-volt, single-pole general lighting circuits and two 110-volt, single-pole appliance cir-

Oakland Fountain and Lighting Control

Light, color, form and motion are synchronized into spectacular fountain display through intricate combination of underwater floodlighting, special programming equipment, banks of relays and fast-acting water valves. Prime contractor for entire project was electrical firm of Ets-Hokin and Galvin.

By Scott Beamer, Consulting Engineer, Oakland, Calif.



HASSLER MEMORIAL FOUNTAIN, situated in small downtown-Oakland park flanked on west side by City Hall, is constantly-changing presentation of lighting and water patterns motivated by underground electrical, pumping and valving equipment. Floodlighting installation includes 57 lensed units containing 300-watt R-lamps, while water pressure is provided through 50-hp pump and numerous solenoid valves.

THE Hassler Memorial Fountain in downtown Oakland, Calif., where patterns of light, color, form and motion are combined in prearranged tempos, presents several innovations in water control. The main central jet is turned on, off, then on again in such staccato fashion that water from one upward burst falls back upon subsequent resurgent jetstreams at half their normal heights, resulting in spectacular mid-air "explosions." Also combined in a 90-second cycle are satellite jets and "rings" that rise and fall or arch across the fountain pool from one side to the other, while banks of "fog" are intermittently created to periodically "curtain" the periphery.

Simultaneously, a 5-color spectrum is projected upwards from scores of underwater floodlights, the colors (yellow, red, blue, green and white) as well as the water patterns being activated by motorized cams, fingers, relays and contactors that can precisely integrate the tempo of these liquid-light effects with carefully scored symphonies or dance arrangements.

The result is a truly "busy" fountain, for automatic full-on-fulloff jets operate 80 times an hour while side jets operate on the average of every six seconds. These valve operations, totalling several million per year, are raising professional eyebrows, for the initial consensus of valve manufacturers was that the specified opening and closing characteristics would be impractical (if not impossible) from engineering as well as economic standpoints. The values, however, were designed without benefit of pattern or prototype, and are rendering a high order of troublefree service.

Heart of the control system is an intricate, automatic lighting and valve timing (or programming) mechanism, consisting of motor-driven gears and shaft-mounted cams and fingers that activate mercury relay contactor coils (for light-

A NEW ERA IN RELAY LIFE AND RELIABILITY!



THEY MAY LOOK ALIKE, BUT

these new relays completely outmode the usual concepts of relay life and reliability.

For years the Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and their consistent, trouble free operation. In having produced millions of these relays, we learned how to improve them. Thus, the new line of Type B and Type BX relays was designed to set a new level of performance standards.

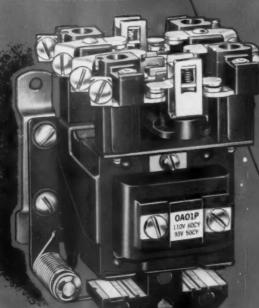
Turn the page and see the outstanding features of these new Bulletin 700 Type B and Type BX relays. For the same price, they offer you even greater value, greater reliability.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.



Type BX-440 Relay





NEW Bulletin 700, Type B-220A AC Control Relay with 2 N.O. and 2 N.C. contacts



New Bulletin 700, Type BX-440A AC Control Relay can be wired for normally open or normally closed contacts

ALLEN-BRADLEY

QUALITY MOTOR CONTROL

NEW BULLETIN 700 RELAYS

TYPE B AND TYPE BX

provide these improved features



- 2 New contact motion provides 10 times greater electrical reliability.
- Compact construction—new relays are structurally improved with no change in size.
- Complete interchangeability. Mounting dimensions of new relays have not been changed.
- 5 Rugged, high efficiency cast plastic coil. New, improved coil fits all Bulletin 700 relays.
- New, stronger, movable contact crossbar—fits
 Bulletin 700 rolays now in service.
- Improved stationary contact blocks. These new blocks can also be used on present models of the Bulletin 700 relay.
- 8 Increased life and reliability—no increase in cost.
 These new, improved relays are priced the same as previous Allen-Bradley models.
- The letter A is added to the Bulletin 700 relay type number merely to distinguish the new line.
- These new relays are Allen-Bradley's "thank you" to our many customers who have bought millions of Bulletin 700 relays over the years.



The old Bulletin 700 relay was first placed on the market some 25 years ago. Today, millions of these relays are in daily service—all over the world.

None of the old relay "values" have been lost in the new designs. Instead, these "values" have been greatly improved. The new relays feature a simplified, longer life, solenoid construction. The double break, silver alloy contacts are the same—always in perfect operating condition—without cleaning or filing. The operating coil has been greatly improved —it cannot be damaged by atmospheric conditions, no matter how severe.

No one can deny the popularity of the older Bulletin 700 relays. The new relays—with their superior features—will be an even better answer for any and all relay applications.



TYPE B, GENERAL PURPOSE
Bulletin 700, 8-pole relay. Made
with 8 N. O. and no N. C., or up to
4 N. O. and 4 N. C. contacts.



TYPE BX, UNIVERSAL
Bulletin 700, 8-pole relay with
both N. O. and N. C. contacts.
Changeover is made by reconnecting incoming lines.



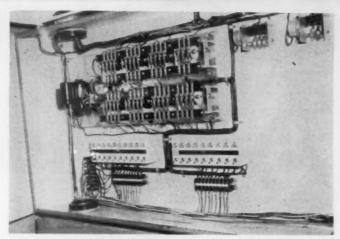
HERE IS ANOTHER REMARKABLE ADDITION TO THE ALLEN-BRADLEY RELAY LINE

It's new... and it's different. This unusual Bulletin 700 convertible contact relay has contacts that can be changed from normally open to normally closed operation (or vice versa)—in just moments. A screw-

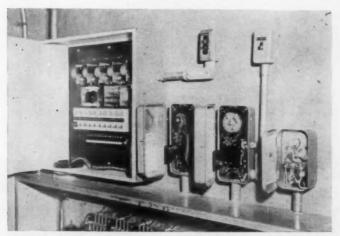
driver is all it takes to do the job no additional parts are needed. Like all A-B relays, it's good for millions of trouble free operations. Watch for announcement and full details of this new convertible relay soon!

ALLEN-BRADLEY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin In Canada: Allen-Bradley Canada Ltd., Galt, Ont. QUALITY MOTOR CONTROL



HEART OF CONTROL SYSTEM is motor-driven cam shaft that progressively makes and breaks circuits related to relay contactor coils (for lighting effects) and remote valve solenoids (for water action). Neon glow-lamps at bottom of panel indicate temporal status of liquid-light displays, while row of 3-position toggle switches may be flipped up for automatic action, down for manual control, or horizontal to take circuit out of action.



RANDOM TIMER at left may be used to change lighting and water combinations when normal-operation programming components are temporarily inactive to permit changing of timing cams or for maintenance. Micro switches of random mechanism are intentionally set to operate "out of step" so that specific light-water combinations do not repeat for several hours. Astronomical clocks at right turn display on and off at predetermined times.

ing circuits) and valve solenoids (for water effects). Cams can be cut and changed at will, making it possible to vary the "script" for special holidays or seasonal displays.

In addition, a "random timer" is provided so that, when timing cams are being changed or the automatic mechanism is being serviced, lights and water combinations may be progressively altered in cycles that do not repeat themselves for hours.

Either of these two automatic control arrangements may be acti-

vated by astronomical clocks that turn the display on and off at predetermined hours throughout the day or night. Or, if it becomes desirable to operate the fountain by hand, this can be done by flipping related 3-step toggle switches from Automatic, through Off, to their Manual positions. When so arranged, colors and water combination can be arranged for static effects, or lights and jetstreams may be modified to compensate for existing wind or daylighting conditions.

Underwater floodlights are wired

through semi-rigid plastic pipes laid on top of (rather than beneath or in) the pool's underslab.

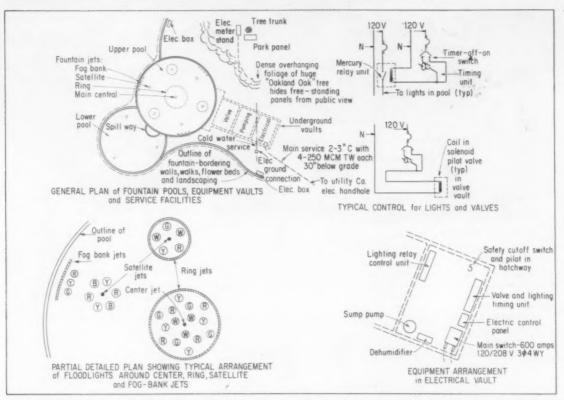
Floodlights are mounted on adjustable-height yokes secured semipermanently by bolts and anchors embedded in the pool's bottom slab, while water level in the pool is maintained within close upper and lower limits (just sufficient to cover the floodlight lenses) by means of float switches, relays and controls that regulate the operation of a magnetic feedwater valve.

From a purely mechanical viewpoint, it is of further interest to note that the fountain was constructed entirely without nozzles, the designers having discovered through experimentation that, without the use of individual petcocks, jetstreams could be satisfactorily controlled and arranged by using varying lengths, diameters and configurations of flexible copper tubing.

Such experimentation showed that the points where water jets "break up" into masses of tiny "beads" are determined by the lengths of the tubing, a 4-in. length of 1-in. tubing driving a jet 4 to 5 ft before breakup, and a longer tube having the same diameter driving an undivided jet to twice those heights. This action may be likened to a comparison between a rifle and sawed-off shotgun, the greater distance without a scattering of shot being related to the gun with the longer barrel. Of course, to produce water jets higher than about 15 ft, larger-diameter tubing was used.

These "breakup" elevations were considered of definite importance from a lighting standpoint, for it was found that maximum reflection of light, as well as most exciting effects, occur just prior to breakup, when spurting water has assumed individual bead effects without having yet turned to spray or "fog." When fog is desired for special effects (as it is during several steps of the fountain's standard 90-second sequence) it is intentionally introduced by special "curtain strips" positioned around the pool's periphery.

This fountain, erected in a small park which is surrounded on its several sides by Oakland's City Hall and a concentration of commercial structures, is effectively framed by attractive landscaping and ornamental cut-stone terracing, and it is backed on one side by a huge, spreading live-oak tree; symbol of



ILLUMINATED, ACTIVATED FOUNTAIN is located in small park in downtown commercial center. Jets (either single or closely spaced to form rings or bars) are shown above by dotted lines, while typical position of underwater floodlight

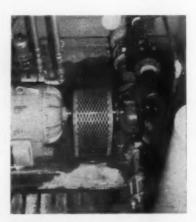
units are indicated in lower sketch. Circular weir permits water to spill from main fountain to smaller pool at lower elevation. Electrical, pumping and valving equipment is buried in underground vaults indicated at right.

the City. So as not to detract from this setting, the related electrical, pumping and valve pits are buried, access to them being obtained through ground-flush hinged manhole doors and descending ladders. The three pits, each having headroom of 8 ft and floor plans of 7 by 12 ft, collectively house all motorized programming equipment, astronomical clocks, relay controls, neon glowlamp transfer switches, a 34circuit breaker panel, a 600-amp 120/208-volt main switch, several sump pumps and dehumidifiers, conveniently accessible emergency switches (to cut off all power to and within the pool in the event that children fall in or go wading). There is, in addition, a thorough equipment-grounding system, a 50hp main pump, series of solenoidactivated water valves, plus automatic magnetic water-level control equipment. Installed within the 30-ft dia. pool itself is a center jet with a surrounding ring of jets, three satellite jets with surrounding rings, three additional satellite jets without rings, and three pe-

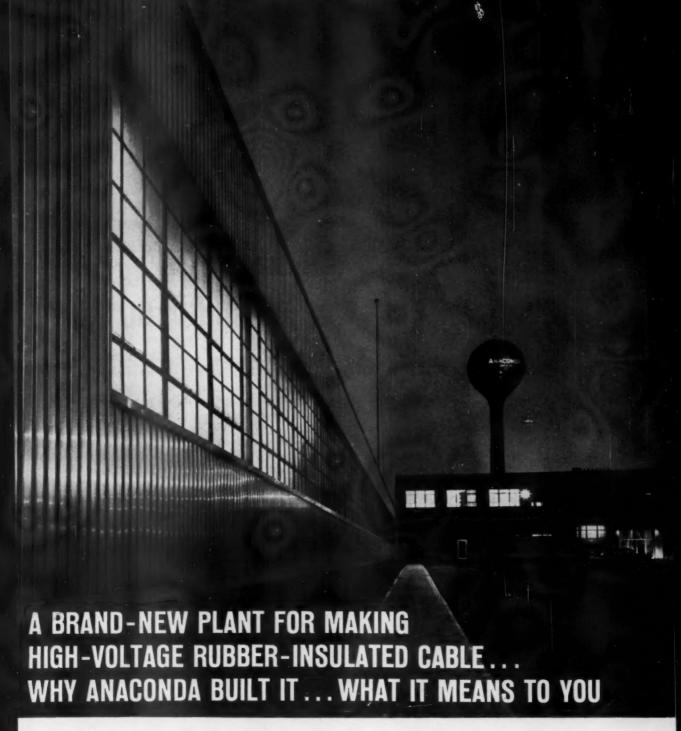
ripheral linear sections for "fog" effects. Each jet, ring and fog strip is separately illuminated by banks of upturned PAR-56 underwater 300-watt floodlights equipped with heat-treated tempered clear or colored lenses ribbed for uni-directional spreads, chrome face rings, surrounding collars for shielding purposes and housings incorporating special mounting yokes.

In contact with the main pool (although placed at a slightly lower elevation) is a second, smaller pool which contains three low-level constant-pattern jets and constant low-intensity white underwater floodlight banks. These two pools "overlap" slightly, with water spilling from the upper to the lower level via a crescent weir.

This project was initially planned and promoted by the author, who assembled a wealth of data on fountain design, then coordinated all electrical, mechanical, civil and structural designs. General contractor on the project was the electrical contracting firm of Ets-Hokin and Galvin of Oakland.



WATER PRESSURE is maintained by 50-hp pump, with action of individual jets controlled by series of solenoid valves installed in adjacent underground pit. Bypass around pump is installed to minimize hammer and chatter when valves are turned full-on and full-off in their stacatto sequence. Although pits were constructed of waterproof concrete and are unusually dry, atmospheric moisture and incidental seepage is further insured by humidifiers and sump pumps. Equipment is housed in three pits reached through manhole doors.

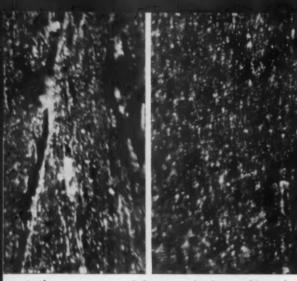


Butyl is the most effective rubber insulation yet developed—either natural or synthetic—for high-voltage cable. It has inherent resistance to aging, to moisture, to heat, and most important in high-voltage cable—to ozone.

But-butyl handles differently from other rubbers. And so it demands specialized engineering knowledge, highly specialized equipment, techniques, and precision control at every manufacturing step.

That briefly is why Anaconda built this huge plant at Marion, Indiana—to combine under one big roof the specialists and the specialized equipment needed to make the finest rubber-insulated cable available to you.

Turn the page to see how Anaconda Butyl (AB) Cable was developed and is manufactured. See how each step helps make a better cable for you.



Above you see magnified sections of ordinary cable insulation (left) and Anaconda Butyl (AB) Cable insulation (right).



These screens, used in the extrusion head to entrap possible contaminants, are so fine they actually hold water.

TWO BIG REASONS WHY ANACONDA BUTYL (AB)

1. SPECIALIZED DEVELOPMENT

Because Anaconda was the first to develop butyl-insulated cable—and because butyl handles differently from other rubbers—many problems came up during development. Here are some examples—and how Anaconda engineers solved them.

A mixing problem: Like all raw rubbers, butyl in its raw state is a practically useless material. So it's mixed with specially selected additives and ingredients. Because it is very difficult to disperse these ingredients in butyl, Anaconda had to develop an entirely new mixing process and separate facilities to avoid contamination. Look at the comparison photos and see how successful it is.

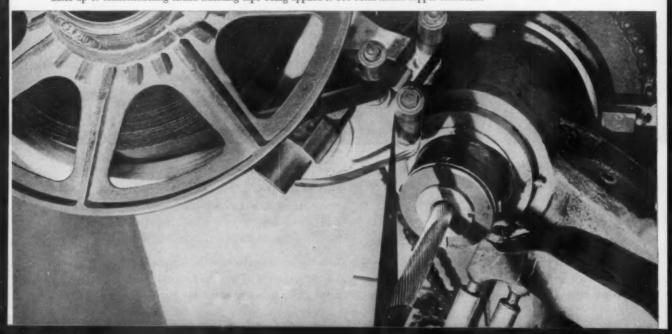
A shielding problem: To eliminate laborious and timeconsuming cleaning of insulation surfaces, Anaconda developed a semiconducting tape* which firmly adheres to the insulation—and yet is easy to remove during splicing and terminating.

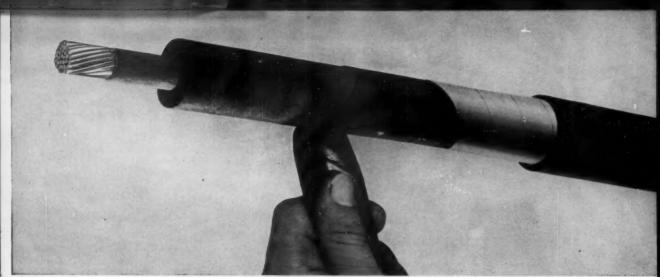
Even a vulcanizing problem: Ordinary vulcanizing equipment might have a tendency to deform butyl insulation. So Anaconda developed huge vulcanizing tanks which admit steam faster, vulcanize quicker and eliminate distortion.

These few examples show you the types of problems Anaconda engineers were up against. Their solutions help show you why you can be sure Anaconda Butyl (AB) Cable is the finest cable you can buy.

oPat. applied for

Close-up of semiconducting strand-shielding tape being applied to 500-Mcm tinned copper conductor.





An Anaconda development-semiconducting tape-adheres firmly to insulation, yet removes easily, facilitating splicing and terminating.

MEANS

RELIABLE

HIGH-VOLTAGE CABLE

2. SPECIALIZED MANUFACTURE

Anaconda's new Marion Mill was designed to handle only one product—Anaconda Butyl (AB) Cable.

The men behind this highly specialized equipment have but one job . . . to study and improve the design and manufacture of rubber-insulated high-voltage cable. Here are a few of the many places where they built precision right into the production line.

Insulation purity: For extra protection against contamination, the unvulcanized Anaconda Butyl is passed through a series of screens, one of which is so fine it will hold water.

Strand-shield taping: For better equalization of internal

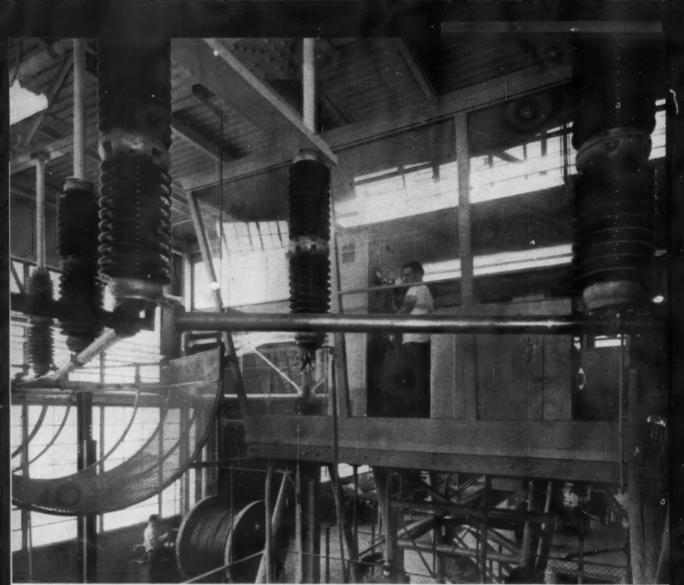
electrical stress, Anaconda applies a special fine-mesh semiconducting tape under the insulation of all stranded highvoltage cables.

Vulcanizing in lead: Conventional lead presses must stop periodically for refilling—severely heating up and often damaging the cable section in the die block, so Anaconda extrudes lead continuously. In the next step, exceptionally large drums are used for vulcanizing in lead to eliminate distortion of jackets and insulation.

These few examples help show you that the manufacture of Anaconda Butyl (AB) is highly specialized, highly precise—and why Anaconda offers you the big advantage of consistent high quality.

Huge reel entering large vulcanizing tank which vulcanizes cable quicker than conventional methods, eliminating distortion of insulation.





Shown here is a section of final testing area. Voltage tests are being applied to full reel lengths of cable before shipment.

ANOTHER BIG REASON WHY YOU SHOULD CONSIDER ANACONDA BUTYL (AB) CABLE—

SPECIALIZED QUALITY CONTROL AND INSPECTION

From the start: Raw-material suppliers are required to sub-mit certified test reports. Then, too, tests and sampling at our plant offer extra protection even before production begins.

To finish: Here's the final inspection line where the finishing touches are applied and where every inch of cable is carefully inspected. Perhaps you already know that Anaconda test procedures are much above industry standards. But do you know that test voltages on Anaconda Butyl (AB) Cable are 125% of industry standards—that minimum corona level is 150% of rated voltage to ground?

Quality control at Anaconda is *more* than mere testing and inspection. It is built into every manufacturing step.

That's why you can be sure your Anaconda cable will be of high quality—why you can be sure Anaconda Butyl (AB) Cable is the finest rubber-insulated cable you can buy.

Everything you need to know about Anaconda Butyl (AB) high-voltage cable is neatly summed up in a new booklet, DM-5903, "Anaconda High-Voltage Durasheath* Cable." Write for your copy today.

*Reg. U.S. Pal. Off. 30256

ASK THE MAN FROM

ANACONDA

ABOUT BUTYL (AB) HIGH-VOLTAGE CABLE

Practical Methods

Trailer-Mounted Cable Puller Has 1½-Ton Tension Capacity

METHOD

Several California contractors handling heavy distribution and pole line jobs are using a self-contained cable-pulling unit consisting of a pair of 26-in.-dia neoprenelined bull-wheels, a tensioner and reel rig, a single-axle trailer for towing behind any motor vehicle, and a power plant consisting of a 30-hp engine designed to develop tensions of 1700 lbs at 3-mph, or, if placed in a lower gear, a maximum pull of 1½ tons.

Developed by Peterson Engineering of Santa Clara, the rig is also



MANUAL TENSIONER, secured to pole support, can also be used to provide pulls of 800 lbs to cables up to 4/0 in size. Unit may be carried in truck, then installed easily by 2-man crew.

equipped with jack-operated pinsecured stabilizing legs, a pivoted sheave assembly that automatically oscillates across a supporting angleand-pipe frame so that cable and reel grooves are kept in vertical alignment, plus a variety of safety and adjustment features.

Since the pulling rig can be removed from the trailer for mounting on barge or truck bodies, it also constitutes a useful tool for trench and underwater cable-laying assignments.

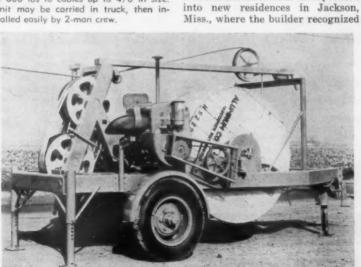
A second, lighter, manual bull-wheel tensioner, developed by the same manufacturer, is also proving useful for tensions up to 800 lbs when cable or conductor sizes are 4/0 or smaller. Weighing only 165 lbs, the unit can be hauled to the jobsite by truck, lifted off by two men and quickly attached to a pole support.

In order to minimize weight to promote handling ease, gears from bullwheels to the disc brake are housed in a magnesium casing. Hollow spindles further reduce the overall weight of this portable double-sheave tensioner.



LIGHTING

Variety in lighting is one of several electrical features incorporated into new residences in Jackson, Miss., where the builder recognized



30-HP ENGINE is linked with pair of trailer-mounted bull-wheels, tensioner and take-up reel to provide hefty pull for trench, underwater, heavy distribution and overhead line work. Adjustable legs stabilize rig during actual pulling operations.



continuous cove along entire winds a wall plus recessed dome fixtures in ceiling provide variety in this attractive den. Ornamental table lamps are included for esthetic purposes as well as for-local illumination for reading.



PLEASANT ENVIRONMENT for dining is obtained by combining an ornamental fixture above the table with a valance that reflects light downwards across the window drapes and upwards to brighten the white plastered ceiling.

that good lighting design is a practical aid in promoting the sale of his homes. And, as the accompanying photos indicate, these several illuminating treatments serve to accent other quality features of construction and decoration.

For example, in the den, a continuous cove along one entire window wall, shielding four 40-watt warm-white rapid-start fluorescent lamps placed end to end, emphasizes the nubby texture of white drapes, the rich wood tones of light mahogany wall panelling and the gay theme of yellow and black cushion patterns. In addition, two 150-watt inside-frosted incandescent lamps, recessed into Lightcraft Domelight fixtures and shielded by chrome semi-spheres, provide highlights and visual interest along the centerline of a rough white acousticalplaster ceiling.



Where portable cord takes a beating because of rugged work conditions, WHITNEY BLAKE DYNAPRENE stands up and gives long, economical service.

DYNAPRENE has an especially tough neoprene jacket, it resists abrasion, has high flexibility and long flex life, and provides premium quality service at competitive prices.





ALL-ELECTRIC KITCHEN contains full complement of major appliances, also variety of general and local-area lighting sources. Plenty of duplex receptacles and phone jacks are added conveniences in this attractive kitchen.

As indicated by the dial adjacent to the kitchen door, lighting in this room is dimmer controlled.

In the dining room, black and white window drapes likewise are illuminated by a 2-lamp cool-white valance, while an attractive luminous-bowl Lightolier fixture over the table incorporates a 150-watt IF lamp in this central location.

Fast becoming the increasing norm for modern homes, the kitchen features such major electrical appliances as the range with lighted exhaust hood above it, sink with built-in dishwasher and disposal unit, also a refrigerator-freezer combination on the righthand wall outside of the camera's angle of inclusion. Counter surfaces are locally illuminated by single fluorescent lamps mounted beneath overhanging cupboards, while general illumination is provided by two coolwhite-deluxe lamps contained in a luminous-enclosure Virden fixture, surface-mounted in the central ceiling area. As indicated by the highlighted enameled surface of the dishwasher enclosure, two additional downlights are ceilingrecessed above this important work center.

Man-Lift Is Time-Saver on 20-Story Skyscraper

МЕТНОО

Those who have worked on tall buildings during construction periods readily will admit that vertical transportation of manpower can be a major problem. For, prior to the installation of ele-



ADD-A-UNIT DESIGN CUTS INSTALLATION COSTS



Individual switch units, even whole sections, can be added or changed as requirements dictate.

Here's the easy, economical way to add new circuit capacity at a moment's notice. BullDog Unit-Versal Switchboards with their flexible design allow you to add Vacu-Break switch units, I-T-E Molded Case Breakers—even complete standard switchboard sections—quickly, safely and economically.

The compact, lightweight sections and switch units are especially designed to conserve valuable plant space. Each distribution section is a front accessible, self-contained board that can be operated alone or in combination with other sections. Individual units or sections can be added or relocated quickly

with just a wrench or screwdriver.

Vacu-Break® switch units provide maximum safety, too. Arcs are smothered quickly inside compact Vacu-Break chambers. Pitting and burning of contacts are reduced to an absolute minimum — maintenance is virtually eliminated.

The Clampmatic® spring assembly inside the Vacu-Break chambers assures clamped-pressure contacts, speeds "break", increases switch life. For safety's sake, lower cost and speedier installation buy BullDog Vacu-Break Unit-Versal Switchboards.



BULLDOG ELECTRIC PRODUCTS DIVISION I-T-E CIRCUIT BREAKER COMPANY

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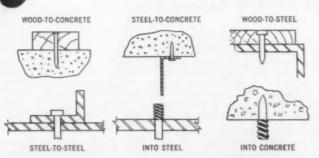
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ONLY RAMSET

"covers all the bases in powder-actuated fastening"

This statement has been made by hundreds of contractors, architects, electricians, plumbers, maintenance men, supervisors, foremen and others over the past ten years! Whatever the job, if it involves fastening into concrete or steel Ramset can do it more easily, efficiently, and with a lower in-place fastener cost.

Threaded studs, drive pins, eye pins—over 100 specialized fasteners team with ten types of powder charges to assure you of just the right holding power for each job. It will pay you to get more details. Your Ramset dealer is listed in the Yellow Pages under tools...call him today!



In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set hammer-in tools for light fastening, and Ringblaster® heavy-duty kiln gun.

Ramset Fastening System



WORKER STEPS OFF rising tread of continuous-belt man-lift as it comes opposite upper terminal landing. If rider should forget to get off, torque of moving step would activate limit switch positioned 18 ins. above top floor, thereby stopping motor instantly. In emergency, motor could also be stopped by pulling control cable mounted alongside guide rails. Abrasive surfacing of steps and landing platforms provide safe footing.

vators, climbing hundreds of steps every day can be rough on leg muscles and hearts. And, even after an elevator or two is available, countless hours can be wasted while men are stranded on different floors awaiting a car not yet equipped with an adequate signalling system or doing double-duty by hauling equipment as well as passengers.

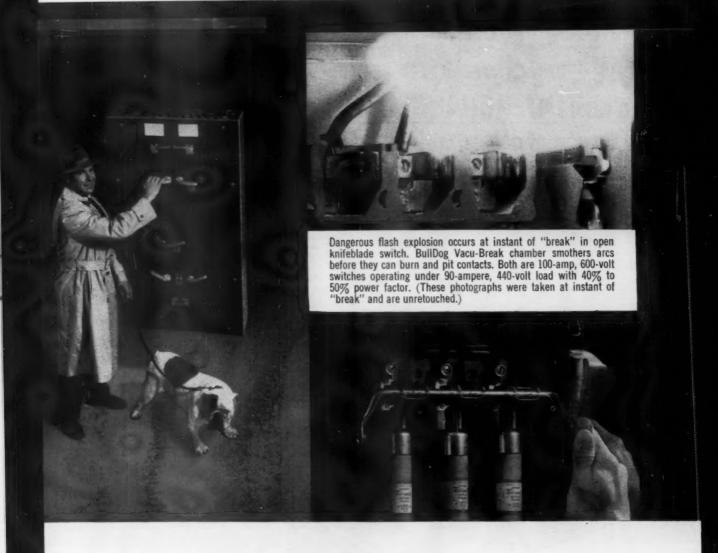
Of general interest to all contractors, therefore, is the use of a man-lift during construction of the 20-floor Crown-Zellerbach office building in San Francisco.

With double-sided steps cantilevered at intervals along a continuous belt, and with handles positioned between steps to permit riders to hang on safely, these manlifts have been used for some time in multi-level garages, where employees are constantly parking customers' cars, then are using these small - area continuously - moving belt-mounted steps to get to another floor quickly.

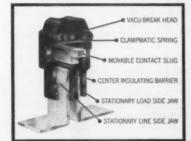
Since such lifts have proved so practical in these prior instances, it is surprising that the idea hasn't been applied more widely to provide fast, easy, prompt vertical transportation for tall-building construction workers.

In the Crown-Zellerbach building, three such lifts were installed; two 7½-hp units having 7-floor limits of travel, and a third unit driven by a 5-hp motor serving a 5-floor run. Cogged drive drums are

WINCHESTER-WESTERN DIV. • OLIN MATHIESON CHEMICAL CORPORATION
289 WINCHESTER AVENUE • NEW HAVEN 4, CONNECTICUT



FOR SAFETY'S SAKE BUY VACU-BREAK POWER PANELS



Close-up of Vacu-Break head shows movable contact slug inside the compact arc chamber. The Clampmatic spring assembly assures a bolt-tight contact, helps speed "break". This combination guarantees positive and safe operation, long switch life. You emphasize safety when you choose BullDog Power Panels with Vacu-Break* switch units! Exclusive Vacu-Break design houses contacts in compact arc chambers that limit the oxygen supply ... actually starve the arc before it can explode and pit or burn contacts. Maintenance is practically eliminated.

Contacts in the Vacu-Break unit are attached directly to the operating handle for positive, safe switching every time. When the handle is in the OFF position—you know the switch is off! For extra safety the

units have interlocking doors. The Vacu-Break unit also provides clamped-pressure switching contacts to prevent overheating. Clampmatic* design simulates a bolted connection when in the ON position . . . accelerates the break, too!

In recent tests, Standard BullDog switches with Amp-Traps** were subjected to 100,000-amp short circuit current. They were undamaged! You provide this extra safety and long-lasting performance by specifying BullDog Vacu-Break Power Panels.



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NOW...GLOBE OFFERS... two new INTERCHANGEABLE trays for support of cables, wiring and tubing



cation wire, instrument tubing and control cables in automation applications.

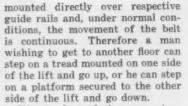
These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.



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The GLOBE Company MANUFACTURERS SINCE 1914
4032 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS



Slip-proof surfacing on steps provide safe footing, while floors are plainly identified both above and below each landing level to give men ample warning when to step off. In addition, red lights (located between the top two and between the bottom two landings) warn riders when terminals are being approached.

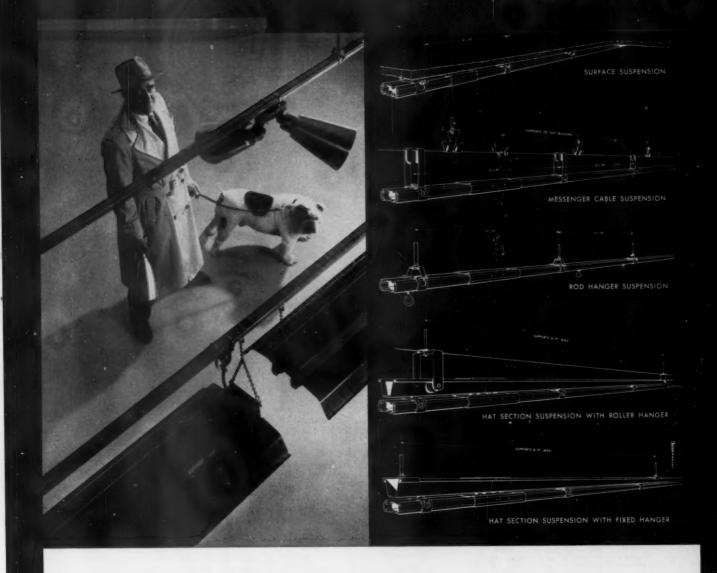
Should a rider forget to get off at either of these terminals, the tangential moment of the step (going beyond these limits with the weight of a man upon it) will trip a limit switch to automatically stop the drive motor. And, should any other emergency condition demand stopping the lift, control ropes (positioned adjacent to each side of the belt and therefore within easy reach of all riders) can be pulled to trip the main switch at the overhead motor site.

Landings at each floor level consist of leveled and securely-fastened #inch plywood sheet covered with non-slip adhesive emery-cloth strips, while guard rails are constructed around each landing area as a barrier to further promote safety.

In the Crown-Zellerbach building, the man-lift was installed by the electrical contractor but was paid for by the general contractor. Each sub-contractor then paid the General a nominal fee of approximately 40 cents per man-day for use of the lift. This amount was considered quite fair by all parties using the facility; the value of time so saved far exceeded this nominal charge, and total payments made the lift a self-liquidating item.

This practical installation was popular with contractors, foremen and journeymen alike, for all waiting for transportation was eliminated, floor-to-floor traffic was prompt and tireless, and economies were therefore obtained in energy, effective working hours and overall costs of completing the work. Of course, due to the confined shaft limits and the possible danger of heavy objects dropping on the heads of riders, carrying tools or equipment by this means was not permitted.

Successful use of the new manlift on this job has prompted its use on future similar projects.



TAKE YOUR CHOICE... UNIVERSAL LIGHTING DUCT OFFERS 5 METHODS OF SUSPENSION!

You can solve virtually any lighting fixture placement problem with Bull-Dog Universal Lighting Duct. The prefabricated, standardized duct is amazingly easy to assemble and you have your choice of five different suspension methods for either the 20-amp or 50-amp ratings. One or a combination of these methods will adapt to any structure . . . and meet any installation requirement quickly and economically.

"ULD" is a continuous electrical outlet, with conductors running the entire length of the duct. Duct sections telescope together mechanically and electrically by a plain coupling. Light fixtures connect quickly by means of twist-out plugs which can be added or repositioned at any point. Plugs are available for direct fixture attachment or will take a standard attachment cap. The duct both feeds and supports fixtures... can be easily disassembled and relocated as lighting needs change.

You'll find Universal Lighting Duct is

less costly than installed pipe and wire. And if the lighting plan is altered during construction, "ULD" can be repositioned without time-wasting "rewiring."

On your next wiring job look into the economies of Universal Lighting Duct. You'll find it is the most efficient, economical and flexible lighting duct system available. "ULD" is U/L listed.



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You don't baby the Knopp Voltage Testers. They're built to withstand the shocks of rugged daily use.

To save your time in testing you get the original patented Prod-Mount in the housing, making this tester easier and safer to use. You get the safety of dual indication of voltage by solesoid and secon lump working independently. The scale readings are positive. Signal is by hum and vibration. Insulated for maximum protection.

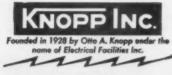
It tells quickly if the circuit is open or closed; magnitude of voltage between 110 and 600 a-c or d-c, pure or rectified; 25 to 60 cycles.

The Enopy Voltage Testers have won iame from coast to coast among engineers, electricians and power companies. So why pay more for a tester when the Enopy Voltage Tester gives you more features and more value at less cost.

There are two models to choose from: pick up one at your dealer today or write for illustrated, free descriptive Bulletin No. 425.

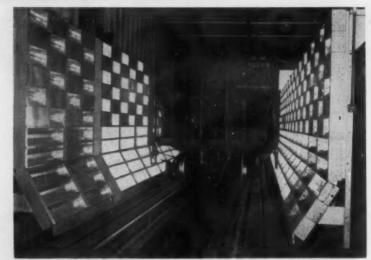
The ENOPP
Phase Sequence
Indicator
60 v. to 600 v.;
25 to 60 cycles;
Rotating Indicator
shows sequence
A-B-C or C-B-A.
Lightweight. Compact. Big time





Dept. A-3

1307 66th Street Oakland 8, Calif.



QUARTZ INFRARED HEAT LAMPS thaw coal frozen in railroad hopper cars. Coal cars are baked in this "lamp oven" in order to thaw coal for rapid dumping. The test installation, using banks of 1600-watt and 3800-watt quartz infrared lamps, is expected to provide less maintenance, greater speed and economy, increased cleanliness, and less damage to railroad cars.

Test Heat Lamps To Thaw Coal Cars

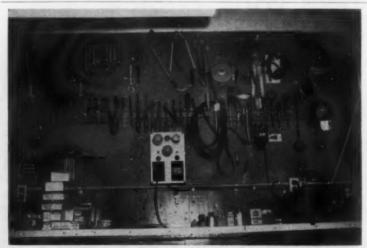
METHOD

Quartz infrared heat lamps are being tested as a means of thawing frozen coal in railroad hopper cars. The infrared lamp thawing system was initiated by the Western Maryland Railroad in cooperation with the General Electric Company, developers of the quartz lamps.

Coal cars enter a "lamp oven" constructed of a steel outer frame that holds banks of 1600-watt and 3800-watt quartz infrared lamps. The heaviest concentration of reflector panels is at the bottom of the car. Duration of a car's stay in the

oven depends upon prevailing temperatures, how solidly the coal is frozen, and the moisture content of the coal. According to engineers, even in zero temperatures it is expected that at least six cars can be thawed and unloaded without the need of manual picking of the lading.

The oven, under test this winter at the Western Maryland Railroad's dockside yards in Baltimore is expected to provide a minimum of maintenance, greater speed and economy, increased cleanliness and less damage to railroad cars.



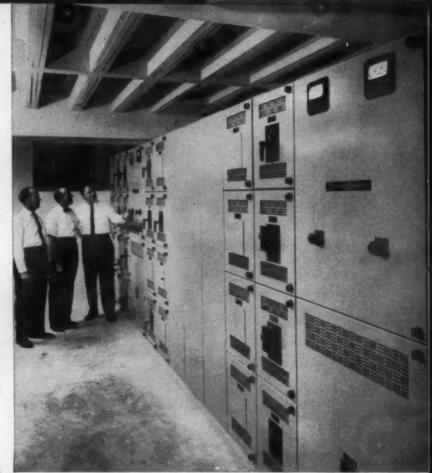
REPAIR CENTER combines testing unit to check either 110v or 220v appliances, plus peg board used to provide a convenient and visual display of hand tools. The assembly, constructed by F. H. Neumann of Neumann Electric, La Crosse, Wis., is located over shop work bench.

Westinghouse local service speeds Miami Airport electrification

Westinghouse Westinghouse

COVER PHOTO: Westinghouse OV-25 mercury-vapor fixtures, with Westinghouse 400-watt color-corrected mercury-vapor lamps, mounted in tandem on standard with transformer base. Shield is Westinghouse design to give complete light control. Discussing airport plans are: George Smith, Howard, Needles, Tammen and Bergendoff, Consulting Engineers; A. K. Ries, Rader and Associates, Design Engineers; James L. Hyland, WESCO sales representative; Charles W. Butsch, Westinghouse sales representative; and Paul Schneider, Job Superintendent, Atlantic Electric, Inc., Electrical Contractors.

Jack E. Mitchell and Leonard Gordon of Mitchell-Gordon Associates, Design Engineers; and Charles Butsch, Westinghouse, examine Westinghouse low-voltage, metal-enclosed drawoutswitchgear, with Type DB-100 main breakers, DB-50 and DB-25 branch breakers, serving Consumer Service area of new airport. Standardized in design, factory-assembled, factory-wired and factory-tested, Westinghouse switchgear provides lower contractor installation costs by eliminating many on-the-job labor costs.



J-94124-2



Charles W. Butsch, with W. F. Stainton and S. R. Insalaco of Florida Power and Light Co., inspects three Westinghouse vault network transformers (Spacemiser design) which furnish power to Consumer Service Building of terminal.



Night shot of "deplaning passenger area," showing the broad expanse of walk and driveway, designed to make airport one of the most serviceable and convenient in the world. Westinghouse industrial-type lights, 2SVP-75, 4- and 8-foot lengths, give maximum light levels, require practically no service and are designed for the quickest, most economical installation.

Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers

Air passenger traffic in and out of Miami, Florida, moves through one of the largest and most modern central-type airports in the world—the new Miami International Airport. Developed and operated by the Dade County Port Authority, and known as the "Gateway to the Americas," this big, new facility handles more than 11,000 passengers per day.

During the planning and construction of the new Consumer Service Building and parking field at the airport, Westinghouse engineers and representatives of its local distribution outlet, WESCO, worked closely with the architects, consulting engineers, general contractors, electrical contractors and airport engineers. Westinghouse equipment was specified for the electrical distribution system and for many lighting requirements.

An important part of the construction planning was the careful coordination of electrical equip-

ment deliveries by WESCO so the schedules of the many firms concerned could be maintained.

Westinghouse equipment included transformers, low-impedance bus duct, both light and power panelboards, circuit breakers, fluorescent lighting for indoors, and special-design airport lighting equipment for outdoors. Westinghouse electric stairways were specified to keep traffic moving smoothly from floor to floor and in and out of the terminal.

Illustrated on these pages are photos of the

Westinghouse

J-94124-3

Over 250 Pages Westinghouse Data in Sweet's Construction File.



W. Robert Little of Fred Howland, Inc., General Contractors; Lamar Seay, WESCO sales representative; and Mannie Marlis, President, Atlantic Electric, Inc., Electrical Contractors, examine transformer room installation in Consumer Service Building which includes two Westinghouse 112 ½-kva, DT-3 dry-type transformers and one Westinghouse Type EPT 15-kva, 3-phase unit with circuit breaker. These smaller, lighter transformers are easily handled, quickly mounted, thereby cutting contractor installation costs.



Lamar Seay and Paul Schneider, Job Superintendent for Atlantic Electric, Inc., shown with Westinghouse air conditioning starter, Class II-750, NS-57, 480-v for one of three 300-ton centrifugal compressors in Consumer Service Building.



Standing before Westinghouse lighting panelboards, Type NLAB, installed behind panels in lobby of enplaning passenger service area in Consumer Service Building, are Harold D. Steward of Steward-Skinner Associates, Architects; Leonard J. Gordon, Mitchell-Gordon Associates; and Charles Butsch. Contractor-Wesco coordination insured prompt delivery of boxes and interiors to meet contractor schedules.



Coordination of Westinghouse equipment meets needs of multiple electrical contractors and consulting engineers (cont'd)

Westinghouse electrical equipment which helped Power-Up the new Miami Airport for present and future operation, and of some of the many individuals who had a part in its planning and construction.

Westinghouse can help you with any phase of your own electrical planning and construction. See your Westinghouse distribution outlet or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

OWNER: Dade County Port Authority

ARCHITECT: Steward-Skinner Associates, Miami, Fla.

DESIGN ENGINEERS: (Outdoor) Rader and Associates, Miami, Fla. (Indoor) Mitchell-Gordon Associates, Coral Gables, Fla.

CONSULTING ENGINEERS: Howard, Needles, Tammen and Bergendoff, Miami, Fla.

GENERAL CONTRACTOR: Fred Howland, Inc., Miami, Fla.

GENERAL CONTRACTOR: Fred Howland, Inc., Miami, Fla.

ELECTRICAL CONTRACTORS: (Outdoor) Astor Electric Service, Inc., Miami Beach, Fla. (Indoor) Atlantic Electric, Inc., Miami, Fla.

ELECTRICAL DISTRIBUTOR: Westinghouse Electric Supply Co., Miami, Fla.

S Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE ... IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

J-94124-4

ABOVE: Night view of airport ramps and parking area. BELOW: Close-up view showing upper vehicular ramps for enplaning passengers.

Advanced methods and techniques were used to prepare Miami's International Airport for its important role in the new Jet Era. An interwoven network of highways, incorporating overpasses and grade separated interchanges, assures free-flowing traffic to and from the airport. The overhead lights in the huge parking field and upper vehicular ramp have specially designed Westinghouse OV-25 units, over 370 fixtures in all. These fixtures, functional as well as decorative, combine glare-free visibility with the virtual elimination of maintenance.



Motor Shops

Grits Blast Booth For Small Motors

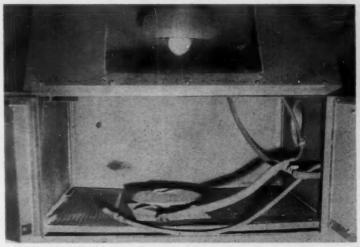
An increasingly larger number of motor repair shops are using corn grits blasting as an effective method of "dry cleaning" dirty motor windings without damage to the coil insulation. The technique is similar to the conventional sand-blasting process used on stripped stators and other metal parts. Although light in weight and of soft consistency, the ground corn cobs (available in varying degrees of fineness) have sufficient physical mass to do an effective cleaning job. Also, the grits tend to absorb much of the oil, grease and dirt dislodged by the blast stream.

When Marion Electric Motor Service. Inc., Marion. Ohio. switched to grits blasting, shop foreman R. L. Patrick designed and built an enclosed booth that incorporates a storage tank and recirculating system for the corn grits. Normally, the grits are reused until visual inspection and "feel" indicate they should be thrown out. Time between changes varies depending upon the amount of use and the type of "dirt" in the windings cleaned.

The booth for small motor work is 42 ins. wide, 32 ins. deep and 36 ins. high; stands 36 ins. off the floor on four angle-iron legs. Sides of the enclosure are sheets of tempered Masonite board bolted to an angle-iron frame. The top panel of the booth front has a glass viewing section; is inclined toward the back so the operator can look down on



MECHANIC "DRY-CLEANS" coils of dirty stator with high-pressure stream of finely ground corn cobs inside grits blast booth.

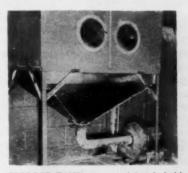


BOOTH INTERIOR showing supporting grid, work turntable, grits hose, air hose and exhaust duct. Hinged front doors close during grits blast operation.

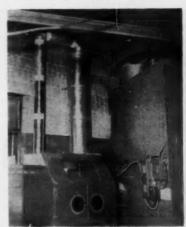
the work being cleaned. Two hinged, Masonite doors with access handholes comprise the front vertical panel of the enclosure.

Inside and under the hood is an electric light, the base of the grits storage tank, the compressed air connection to the tank and grits blast hose and a duct connection to the adjacent large motor booth which has an exhaust fan. Base of the booth is a grid of expandedmetal on an angle-iron frame. This supports a movable 11½-in. dia. steel-plate turntable on a sturdy metal base. Work to be cleaned is placed on the turntable when the booth is loaded. The operator, with his arms through the access holes in the front panel, rotates the work with one hand and directs the grits stream with the other. A separate air nozzle in the booth is used to blow out any grits particles that may have been caught in the coils or motor frame. Air pressure for the grits stream is supplied at 60 to 100 lbs per square inch.

A sheet metal hopper under the grid completes the booth enclosure; catches the grits particles as they drop through the grid; directs them through a round duct to a centrifugal blower which forces them up connecting duct work to the grits storage tank at the top of the booth. The tank holds three 40-lb sacks of No. 250 fine-grind corn grits. A wire mesh at the base of the hopper screens the grits in the re-cycling operation, and excludes large particles from the hopper.



STORAGE TANK at top of booth holds 120 lbs of corn grits. Duct at left connects tank to blower at base of hopper. Enclosure at right is blast booth for large motors.



METAL HOPPER at base of booth feeds retrieved grits to centrifugal blower connected to storage tank return duct.



THE ABOMINABLE WHITE ELEPHANT ON YOUR ELECTRIC BILL

IF YOUR ELECTRICAL SYSTEM is burdened with a low power factor, you're paying for electricity you can't use . . . you're giving up electrical capacity you may need.

The motors and other inductive devices in your plant use both kilowatts (working current) and kilovars (magnetizing current) in order to run. The kilowatts you buy. The kilovars you can best supply yourself. The more you supply, the higher your power factor, and the less you pay the electric company.

Sprague Unipak* Power Factor Correction Capacitors are the most economical and efficient means of supplying your own kilovars. You put them right where they're needed . . . at the motors. Your electric company does not have to send as many kilovars all the way from the power plant, so they charge you less. Your wiring does not have to carry the extra kilovars to the load, so it can handle additional loads.

Actual power bill savings experienced in many plants have more than paid for the Power Factor Capacitors in less than a year's time... in some cases, in less than six months. And as an added dividend, these capacitors have also increased the power handling capacity of many plant distribution systems by an average of 20 %.

You, too, can reduce costs... increase your plant's electrical capacity by installing Sprague Unipak* Power Factor Correction Capacitors. Ask for our handy slide rule calculator which quickly and easily shows the capacitors you need to effect such savings at each load.

Better yet, for free assistance in making a complete survey of your electrical installation to see how much you can save with Sprague Unipak* Power Factor Capacitors, write Industrial Capacitor Division, Sprague Electric Company, 333 Marshall Street, North Adams, Massachusetts.

*Trademark









WORLD'S LARGEST
CAPACITOR MANUFACTURER

SPRAGUE®

Electric Soldering Gun Promotes Shop Efficiency

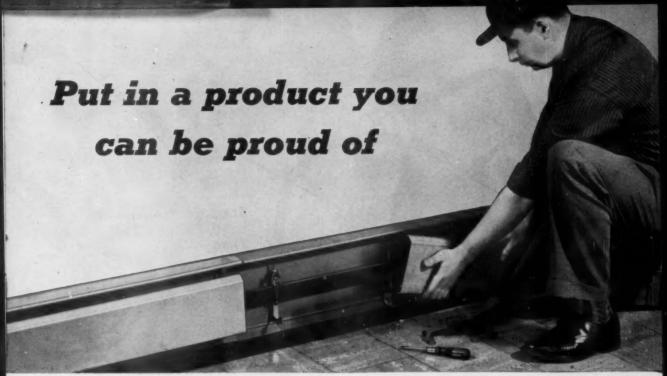
Completing coil connections within confines of small stators can be greatly facilitated through the use of electric soldering guns having electrodes that are long and thin enough to attain positions that would be difficult to reach with blunt-nosed irons. Electric guns. moreover, have the advantages of providing continuous controlled heat and lower overall operating temperatures, both considerations contributing to more uniform working conditions, decreasing the possibilities for inadvertently damaging adjacent insulation coverings, and increasing the speed and resultant efficiency of this essential shop procedure in the rewinding cycle. Still another advantage is that, with high temperatures concentrated within a small area, the possibility of reheating and thereby meltingout already-completed soldered connections is practically eliminated.

These several theoretical values recently prompted one shop owner to first purchase a gun for his personal testing-in-use, then to buy a dozen or more for general use and experimentation by his men, and enable to order a sufficient quantity to equip each bench in the shop with this useful tool.

The guns discussed in this instance are also equipped with twin spotlights, positioned on either side of the pistol-grip frame, so that local shadowless illumination is provided to the work area regardless of the placement or intensity of lighting fixtures installed for general shop lighting. Convenient onoff trigger switches also make it possible to obtain almost instan-



SMALL ELECTRODES of electric soldering gun carry heat to exact point of operations, permitting connections to be made in confined areas without danger of melting-out adjacent connections or damaging nearby insulation. Tiny spotlights placed on either side of pistol-grip frame concentrate beams of local illumination directly upon area surrounding electrodes of this 250-watt shop tool.



Ilg Radiant Baseboard panels arrive on the job in perfect shape—protected in sturdy, easy-to-carry cartons, sized to the individual lengths you need. Ilg baseboard comes in 2', 5', and 8' lengths, for surface or semi-recessed mounting. Open the carton and you have everything you need for the job—back panel with heating element, front panel, full line of accessories.

Finishing Touch. Ilg radiant baseboards are a "snap" to install. You just (1) screw or nail the back panel complete with heating element to studding, (2) connect power to splice box by bringing in wires from rear, bottom or sides, and (3) snap on cover panel, end covers and corner pieces. Baseboard can be painted to match any room color. No primer needed. Send for Bulletin 1401.

INSTALL ILG ELECTRIC HEAT



Good Things Come in Small Packages. Ilg fan-driven electric wall insert heaters pack tremendous heating output into small space. Three sizes deliver 6824 B.t.u./hr., 10,236 B.t.u./hr., 13,648 B.t.u./hr. Finned heating elements are sagproof, moistureproof, shockproof. Thermostat is separately controlled by own selector dial—cannot cause radio or TV interference, operates within 55-85° range.

Separate "on-off" switch sets heater in automatic operation without disturbing comfort level of thermostatic setting. Heavy sheet metal case with baked-on sea-foam beige enamel extends only 1½" into room. Send for Bulletin 1101.



Pick Your Capacity. Ilg electric unit heaters range in size from $1\frac{1}{2}$ to 36 kw. All heaters have non-glowing, steel-sheathed, black-heat type replaceable heating elements . . . superquiet Ilg "Q" type aluminum fan wheel direct-connected to Ilg-built motors. Choice of automatic or manual controls. Capacities from 5118 to 122,832 B.t.u./hr. Complete units bear Ilg famous "One-Name-Plate" guarantee. Send for Bulletin 808.



Name Your Mounting. New Ilg electric cabinet heaters have 2- and 3-speed blow-through or draw-through motors; for floor, ceiling, wall or inverted mounting.

Finned strip heating elements. Highlimit cutout. Permanent or renewable filters. Manual, pneumatic, or automatic electric controls. Capacities 3.33 to 30.0 k.w. Send for Bulletin 1801.



ILG ELECTRIC VENTILATING COMPANY

2879 No. Pulaski Road, Chicago 41, III. :
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)



There's a Royal "POWR-KORD" for every need:

- . RUBBER or VINYL
- BLACK or RED (rubber)
- RED or YELLOW (vinyl)
- . HANDY LENGTHS from 10' to 100'
- . IN THESE TYPES and SIZES: #18 and #16 SJ - 2- and 3-conductor #18 thru #12 5 - 2-conductor #14 and #12 5 - 3-conductor #18 and #16 SJT - 2-conductor



... the all-quality line of all-purpose heavy-duty

Here's the kind of rugged construction that pays off on the job: MOLDED-ON caps and connectors, - built-in strain reliefs - Royalquality cord - heavy brass blades and double-wipe contacts - lockedin-place molded construction . . . and FULLY UL LISTED!

Next time you're ordering electrical supplies from your wholesaler, be sure to include Royal "POWR-KORDS".

ROYAL ELECTRIC CORPORATION Pawtucket, Rhode Island

In Canada: Royal Electric Company (Quebec) Ltd.
Painte-Claire, Quebec

taneous heat from these ruggedthough-small 250-watt tools, while release of a switch promptly interrupts current being consumed upon completion of the process-at-hand.

Completing this connecting routine, all twisted and soldered unions are finally insulated with plastic tape, and group leads are then tied in place with nylon cord to keep them secured after the motors have been reassembled and replaced in service.

Drum Controller Cuts Multi-Voltage Test

Multi-voltage, multi-phase, multispeed motors can be given running tests at a single panel at the large motor repair department of Electrical Engineering and Equipment Company, Des Moines, Iowa. Panel arrangement and circuiting provide test facilities for 110-, 220-, 440volt; 2-phase, 3-phase; one-, two-, four-speed; constant torque or constant horsepower motors.

A considerable slash in test "setup" time resulted when shop engineers and mechanics converted conventional drum controllers into selector switches for the multi-voltage testing. The bench-mounted rebuilt controller illustrated has a total of 116 contact points which engage combinations of some 21 contact fingers as the drum is rotated in prescribed positions. Top of the drum has an "off" position and 11 test positions to handle the variety of motors encountered. Test leads from the controller pass through a numbered panel at the



DRUM CONTROLLER, converted to selector switch, has 11 test positions involving 21 contact fingers and 116 drum contacts.



Hundreds of good reasons why Clark "PM" Relays are worth waiting for

The word is out about the most complete, integrated line of control relays available today.

If your shipment of Clark "PM" Relays has been delayed, please be patient. There's a very good reason. Seems like everybody wants them.

It all began when Clark first announced the completion of a *full line* of "PM" Relays. We were literally snowed under by an avalanche of orders.

We're happy to report, however, that our manufacturing facilities have been expanded to meet the demand and we're rapidly catching up—even though the avalanche continues.

Is it any wonder when you consider the many advantages the Clark "PM" Relay line offers: modular construction that makes possible integrated uniformity, compactness and flexibility...neater, more uniform panels...the greatest possible use of every square inch of valuable space.

Is it any wonder also, when you consider that every relay in the Clark "PM" line is manufactured with the same careful attention to detail that has long made Clark "the standard of quality" for industrial control.

No time-saving production short cuts are worth sacrificing this quality, even in the face of the tremendous demand created by customer preference. In fact, we're sure our customers wouldn't have it any other way.

Your Clark Controller sales representative or distributor will be glad to give you more reasons why Clark "PM" relays are your best control relay buy—well worth waiting for. Contact him or write direct to Clark Controller.





Use the Jet Line Gun to shoot a then draw polyethylene rope through

the trick, twisting around ells and bends, up and down as it lays the nylon line in runs up to 300 ft. . . . double this distance when shot from both ends of the run!

The Jet Line system is safe there's no powder charge or explosion . . and both nylon line and polyethylene rope are non-conductors.

The Jet Line system is accurate. You can't waste wire because the polyethylene rope is marked in feet to measure the exact length of wire you need.

and you're ready to pull wire . . . in minutes, not hours!

Goes through floor boxes and C condulets Saves time, money and wire

Order your Jet Line Gun Kit TODAY!

Invented by experienced electricions

In use by thousands of contractors Use in rigid and flexible steel conduits

Use in underfloor ducts, cavity wiring

structures and underground ducts

Pat. Pending on Method and Apparatus Ask your distributor or write Gun Company 30 Seigle Street, Charlotte, N. C



TEST LEADS from drum selector switch have identifying numbers matching those listed in framed connection and test instructions on panel in background.

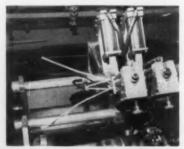
controller case; terminate in insulated alligator clips correspondingly numbered.

The connection instructions are framed on the face of the test panel. They tell the mechanic what test leads to use, what controller position to use, and what panel button to push for each of the multiple test setups available.

Drop-Link Coil Stop For Pneumatic Spreader

Mechanics in the large motor repair department of Electrical Engineering & Equipment Co., Des Moines, Ia., are constantly striving to improve individual operations to boost overall shop efficiency. Even when a new piece of modern equipment is added, they devise refinements of their own. One of these is a simple, adjustable drop-link coil stop which A. B. Hartman added to a pneumatically operated coil spreader.

Before he designed the coil stop, Hartman used a spacer block be-

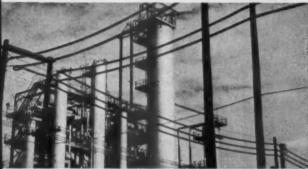


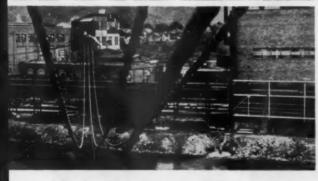
STOP-BAR yoke is attached to back gauge bar of pneumatic coil spreader. Drop-link (arrow) in "up" position lines up with coil clamp fingers. Coil nose rests against link while clamps are set.

How Okonite solves your High-Voltage Distribution Problem

Reliable primary distribution is a <u>must</u> for efficient, economical operation. As the use of higher voltages increases, the problems of keeping primary distribution reliable increase too. But, whatever your specific need, Okonite has designed a construction that will do the job...like those shown here.









OKOLITE-INSULATED

This Okolite-insulated 25kv submarine power cable, installed by Bonneville Power Administration under Puget Sound, was 7½ miles long, weighed ¾ million lbs. It is typical of the many Okolite-insulated cables designed to solve specific high voltage power problems. Other constructions for underground, aerial, duct or interior installation are frequently protected by an Okoprene (neoprene) sheath, compounded to Okonite's own formula for high weather, temperature and abrasion resistance. Okolite oil-base insulation has demonstrated in more than 30 years of service its high dielectric strength, moisture-resistance and stability in all types of installation conditions. All Okolite-insulated cables must withstand self-imposed a-c and d-c voltage tests that are highest in the industry.

OKONEX-OKOPRENE

This Okonex-Okoprene 15kv primary distribution system was installed to save space, eliminate safety problems and provide improved voltage regulation at Magnolia Petroleum's 1500-acre refinery near Beaumont, Texas. Okonex (butyl-base) cables are highly resistant to heat, and are often specified to give additional protection in high ambient parts of the plant or to provide additional ampacity in circuits. The Okoprene sheath provides excellent protection against moisture and corrosion as in Magnolia Petroleum's refinery where there was a high moisture-saline content in the air plus chemical atmospheres at many of the processing units.

SELF-SUPPORTING CABLE

These four 7500-volt Okolite-Okoprene self-supporting aerial cables span 395 feet to distribute power to a section of a Southern paper mill. Easy to install in one simple operation, Okolite-Okoprene self-supporting aerial cable reduces clearance space requirements, is neat-appearing, often may be installed on existing buildings or supports, offers greater safety to personnel and eliminates insulator flashover due to contamination. Okonite's patented Dualay assembly can be tapped hot at any point in non-shielded types.

LOXARMOR

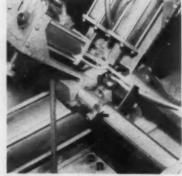
And on any high-voltage construction, a Loxarmor covering offers economy and flexibility in a cable system where the complete protection of a rigid conduit system is not required. Excellent mechanical protection is provided by a Loxarmor interlocking "S" tape available in galvanized steel, aluminum, bronze or copper. Loxarmor saves money in installation and initial purchase costs, makes it easy to add or re-route circuits and requires less space than conduit to handle the same number of circuits.

One of these high-voltage cable constructions will fill your requirements. Write for Bulletin EC-1117, "How to Choose Insulated Cable," to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.



where there's electrical power...there's OKONITE CABLE





SET SCREW and lock nut (arrow) securely position sliding yoke at any desired point along gauge bar. Each coil size requires only one setting. Link positioning coil can be flipped "up" or "down" as required by spreader operation.

tween the nose of the hairpin coil and the preset coil clamps to accurately position the coil in the spreader. While this worked well, it was a rather time-consuming multiple-operation: pick up the block, place it in the coil nose for positioning, take out the block and set it down. This had to be repeated for each coil of the set being spread and new blocks had to be measured and cut for each size coil. The coil stop simplifies this operation considerably. Once it is set on the back gauge bar of the spreader, coils are held against it while the clamps are set. The drop-link is flicked down out of the way so the "knuckle horn" can be attached to the coil nose and the spreading operation completed.

The coil stop is supported by an adjustable metal yoke (§ in. wide, § in. thick) which fits around the cylindrical gauge bar supporting the two rear pneumatic fingers



DROP-LINK in "down" position (arrow) after spreader clamps are set clears way for "knuckle horn" to be rolled in and attached to coil nose.

Announcing A NEW TYPE SEALTITE SERLTITE - 1/2" +221F FOR HOT SPOTS HOSE-OR COLD SPOTS ANACONDA META

SEALTITE, TYPE H.C. (HOT-COLD), FLEXIBLE, LIQUID-TIGHT WIRING CONDUIT THAT WITHSTANDS TEMPERATURES FROM +221°F. TO -40°F.

As design conditions for electrical equipment become more rigorous, flexible, liquid-tight conduit must be able to protect connections in even higher—and lower—ambients.

To meet the more severe temperature conditions, Anaconda Metal Hose Division has developed a new type of Sealtite—Type H.C. Tests show that Sealtite, Type H.C., operates safely at temperatures up to 221°F., and as low as —40°F. Its tough jacket is unimpaired, and the conduit remains liquid-tight

and flexible throughout the range.

Sealtite is sold by leading Electrical Wholesale Distributors. For more detailed information on Type H.C.—or technical assistance in applying it to your tough new jobs—write: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn.

In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. Sealtite is approved by Canadian Standards Association.



CUTAWAY SECTION of Sealtite, Type H.C., shows tough extruded polyvinyl chloride jacket over flexible galvanized steel core, Insist on the conduit marked SEALTIT

flexible, liquid-tight conduit

an ANACONDA® product



1. YOU SPEED YOUR WORK—There's no time lost hunting for individual parts. You save time in filling out orders and in billing. Every part you need comes in one

 YOU DO A BETTER JOB—All parts are genuine Wagner replacement parts. They fit right because they're exact duplicates of the original parts.

Kit SA-2392 is for Wagner RA and KA motors in the 56, 57 or 65 frame sizes. Kit SA-2393 is for Wagner RB and RK motors in the same frame sizes. Order a supply of each today.

BUILD NEW MOTOR SALES WITH THE WAGNER MOTOR MERCHANDISER

When a customer brings a motor in that is not worth repairing, sell him a Wagner Replacement Motor. This attractive Motor Merchandiser helps do the job for you. Just \$9.95 with your order for any 10 Wagner Motors in one lot.



WR59-6

Wagner Electric Corporation

6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S. A.
OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

MOTORS . BEARINGS . STANDARD ROTORS . BRUSHES . CAPACITORS . COMMUTATORS



BOLT EXTENSION added to yoke (arrow) positions drop-link for long hairpin coils whose noses extend beyond range of gauge bar.

which clamp one side of the coil. The front of the yoke has a ½-in. steel tab to which the drop-link is bolted. A nut welded to the back of the yoke seats a ½-in. Allen set screw which securely positions the yoke at any desired setting on the gauge bar. Positive locking is provided by a set-screw nut which tightens against the yoke after the screw is drawn up tight. The yoke can be attached to the left or right side of the spreader to fit mechanic convenience.

The drop-link portion is a 3½-in. length of %-in. steel bar, 1 in. wide. When used as a stop bar for positioning the hairpin coil, it is pointed upward in line with the clamp fingers. After the clamps are set, the link is pushed down to provide a clear path for attachment of the "knuckle horn" to the coil nose.

For long hairpin coils, whose ends extend beyond the range of the gauge bar, an extension bolt is used. The yoke is securely positioned at the extreme end of the bar, the extension bolt added, and the droplink fastened to the end to function as an effective stop bar for large coils.

Electrical Engineering & Equipment Co. mechanics like the simplicity of this device. It's easy to use and adjust. And the saving of even a few seconds time per coil soon adds up to a healthy man-hour economy in the spreading operation.

Spreader Bars Keep Chain Slings Vertical

A substantial degree of safety and convenience has been added to equipment hoisting techniques in the large motor repair division of Electrical Engineering & Equipment Co., Des Moines, Iowa. Shop mechanics have fabricated a series



CHAIN SPREADER for hoisting transformers keeps slings in vertical position, prevents slippage and possible equipment damage.

of spreader-bars to vertically suspend chain slings to equipment lifting hooks. By eliminating the normal triangular pattern and resultant "binding" effect of a conventional hook-suspended sling, chain slippage and damage to equipment surfaces has been minimized.

The 30-in, bar (illustrated) used to hoist medium sized oil-cooled transformers is typical of the chainspreader design. Slings are suspended from a section of 1-in. dia cold rolled steel bar with positioning-ridges welded on top at about 4-in. centers. A triangular bracket made of two parallel 12-in, cold rolled steel bars supports the chain bar. Bracket vertex, through which hoist hook is placed, is about 6% ins. above the center of the bar and has a reinforcing ring welded to bar and bracket. All joints are securely welded for added strength.

While the general design is fairly standard, spreader dimensions and steel bar size vary with the bulk and weight of equipment to be handled. Some of the smaller chain-spreaders occasionally are used to move heavy magnet wire reels, or provide a temporary dereeling facility.



WIRE REEL is lifted with chain spreader. Vertical slings can be adjusted to fit reel width; permit rotation for wire payout.

The only fixture hanger with 10 different choices of receptacles . . .

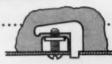
"Three-Sixty"

FIXTURE HANGER



- Exclusive friction-ring suspension rotates all the way around.
- 10 different receptacle types—one for every job requirement—exclusive "Three-Sixty" feature.
- Aligns fixtures instantly, at any angle with just a twist of the wrist.
- Simplifies engineering design, permits hanging two or four chains, or "S" hooks, from small compact arms.
- Bright Cadmium plated overall, provides neat, attractive installation.

GET FULL FACTS...SEND COUPON



SAFETY BRACKETS

Models are available with safety brackets, detailed above, which will hold on box ears should screw vibrate loose. Designed for use with 4" concrete rings, octagon boxes and round fittings.

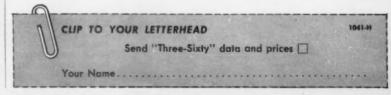


For every fixture position

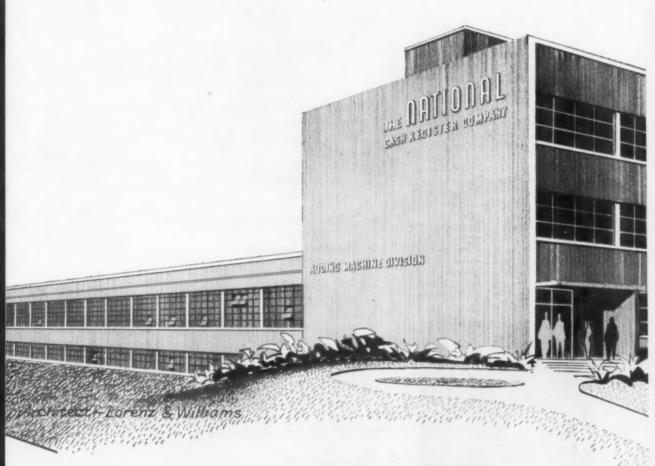


IDEAL INDUSTRIES, INC.

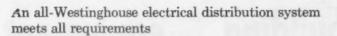
1041-I PARK AVENUE • SYCAMORE, ILLINOIS



Panelboard planning helps Power-Up The National Cash Register Plant



Owner: The National Cash Register Co., Dayton, Ohio Architects: Lorenz and Williams, Architects and Engineers, Dayton, Ohio Consulting Engineer: Schweiger, Heapy & Associates, Dayton, Ohio General Contractor: Streeter Associates, Inc., Elmira, N. Y. Electrical Contractor: Buffalo Electric Co., Inc., Buffalo, N. Y. Westinghouse Distributor: Buffalo Electric Co., Inc., Buffalo, N. Y.



The new Adding Machine Division Plant of The National Cash Register Company in Ithaca, New York, was carefully planned to provide for efficient production and future plant expansion. Completely Westinghouse equipped, this new plant has a 50% reserve electrical capacity that can be utilized readily with the spare equipment now installed.

Westinghouse works closely with you in planning for future and present electrical needs, and in providing flexible and efficient systems that can be adapted to any changes in your production methods. Find out how Westinghouse Power-Up planning can increase the efficiency of your installation. Contact your nearby Westinghouse office, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-93549

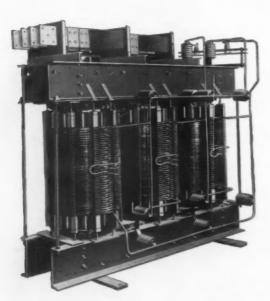
YOU CAN BE SURE ... IF IT'S Westinghouse

Clair Dean, B

Clair Dean, Buffalo Electric Co., Electrical Contractors, and John M. Schweiger, Schweiger, Heapy & Associates, Consulting Engineers, are shown here in the electrical equipment room. On the wall facing them can be seen four Westinghouse panelboards. Two of the panelboards are NLAB 120/240v, one is an NHIB 277/480v, and the opened panelboard in the foreground is a CDP 277/480v.

Your plant ... building ... equipment depend solely upon the transformer





2000 Kva 3-phase 15 KV transformer, core and coils only. Illustrating disc type continuous windings without splices and substantial supports of all terminations.

The dry-type transformer is the heart of your entire electrical distribution system. Its continuous, reliable and economical performance is vital to every operation . . . from heavy machinery and production equipment, to the air-conditioning and light in your office.

SORGEL sound-rated dry-type transformers assure you of ...

Time-Tested Reliability . . .

Nearly half a century's experience in the development, manufacturing and application of transformers, in world-wide use.

Installation Flexibility . . .

Place at any convenient location near the load center . . . reduce long feeder runs . . . provide greatest economy.

Lowest Sound Level . . . Highest Efficiency

Originators of low sound level. Soundrated up to 10,000 KVA. Lowest core and copper loss, resulting in minimum operating costs.

A Complete Line . . .

 $\frac{1}{4}$ KVA up to 10,000 KVA. 120 volts to 15,000 volts. Also transformers for special applications and saturable reactors to regulate and control electric power.

Compare before you buy or specify. Then, select the best dry-type transformer, made only by

Sorgel Electric Company

836 West National Avenue, Milwaukee, Wis.

Sales engineers in principal cities.

Consult the classified section of your telephone directory or communicate with our factory.

THE LARGEST AND OLDEST EXCLUSIVE MANUFACTURER OF DRY-TYPE TRANSFORMERS

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NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

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Use first line of boxes. Insert item numbers of products on which more information is desired.

 CATALOGS, BULLETINS AND ENGINEER-ING DATA:

Use second line of boxes. Insert item numbers of literature desired.

ADVERTISEMENTS:

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

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Product News



(1)

Safety Switches

A new design of light and heavyduty switches feature a red insulated front-operating handle and a large nameplate to provide ON-OFF identification from 100 ft away. Additional features include: the elimination of fiber parts from the operating mechanism; visible blades: wiring gutters free from moving parts or obstructions; and a safety phase barrier which protects maintenance personnel from accidental line-to-line contact when inspecting a live switch. Ratings are 30- to 600-amp, 120/240 volts ac, and 600 volts ac for the heavyduty switches. Bulletin available.

Circuit Protective Devices Dept., General Electric Co., Plainview, Conn.

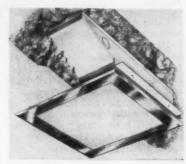


Pump Control

Complete with a fusible disconnect switch or circuit breaker, and a motor starter, a new pumping control is designed for all weather outdoor use. The disconnect or circuit breaker is operated from an external handle and must be open before the enclosure door can be opened. Starters are available with 2 or 3 thermal overload relays. In addition to a "start" pushbutton, a "Hand-Off-Automatic" selector switch is provided for automatic

control circuits. For resetting the overload relays, an external reset button is provided. Bulletin 8940 is available.

Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.



Recessed Fixtures (3

Availability of a new series of UL approved, shallow, recessed lighting fixtures designed especially for use in concrete pour construction has been announced. Provided in either 100- or 150-watt, the units are completely factory assembled and come equipped with a prewired compartment integral with the housing. Wiring within the units may be accomplished before or after pouring. A removable top on the housing allows pre-wiring while a large access plate inside the housing permits wiring after the concrete is poured. Units are available with two different frames and a variety of round and square glass and lens.

Prescolite Mfg. Co., 2229 Fourth St., Berkeley, Calif.

Electric Furnace (4

An electric furnace has been added to the "Landmark" line of central residential forced warm air heating and cooling equipment. Designed particularly for convection heating using electricity as fuel, the new electric furnaces are 19 ins. high, with cabinet dimensions matching other Landmark blowerfilter and cooling sections. Btu outputs for the electric furnaces range from 68,300 to 123,000. Kw requirements from 20 to 36, using single or 3-phase current. Cfm from 620 to 2200. Thermostats are 2-stage, pulling in only part of the heating capacity on the first stage.

Lennox Industries Inc., Marshalltown, Iowa



Fluorescent Fixture

(5)

Designed for store and office lighting, new fluorescent fixtures are available with either plastic side windows or solid steel sides. Called "Futurliters," the fixtures are furnished in 4- and 6-light units with either louver diffuser bottoms or reversible prismatic louver-lens. The 2-ft wide fixtures can be ceiling or pendant-mounted, in continuous rows or individually.

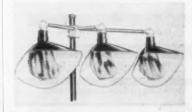
Edwin F. Guth Co., 2615 Wash-

Edwin F. Guth Co., 2615 Washington Blvd., St. Louis 3, Mo.

Screw Anchor Kit (6

A new screw anchor kit includes 100 "Wally" plastic anchors, 100 No. 10 by 1 in. sheet metal screws and a ½ in. carbide tipped masonry drill, packaged in a transparent plastic box. Plastic anchors can be used for hollow or solid wall construction. Made of white tenite plastic, anchors can be used outdoors or indoors, and will not corrode.

Holub Industries, Inc., Sycamore, Ill.



Floodlights

(7)

Over 120 different floodlights are offered for industrial and sport lighting. Units can be furnished with incandescent, mercury-vapor and bi-post luminaires. Included in the line are open and enclosed reflectors for mounting on pipe standards, crossarms, walls and other flat surfaces. Literature is available.

Quadrangle Manufacturing Co., 32 S. Peoria St., Chicago 7, Ill.

PLUGMOLD° **GIVES MORE** OUTLETS FOR LESS MONEY

Easy installation on any surface gives lowest-cost way to provide lots of outlets wherever desirable. Planning flexibility, simplicity of later additions of circuits or outlets, also help make PLUGMOLD easy to sell. Get it from your distributor.



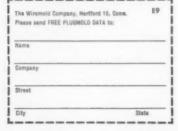
PLUSMOLD 2000 (UP TO 3 NO. 12 CONDUCTORS)

PLUGMOLD 2100 (UP TO 10 NO. 12)

PLUGMOLD 2200 (UP TO 3 NO. 6: 10 NO. 10)



ALL PLUGMOLD IN BUFF OR GRAY PRIME COAT





Insulators

Designed to cope with the trend of increased voltages and air-borne contaminations, a new "Futura" suspension insulator series is offered in 18,000-, 25,000- and 36,000lb M&E ratings. High strength is claimed through design changes in the cap and pin, and through a new shape for the porcelain body. As a result, both dielectric and mechanical strength have been increased with a decrease in the amount of porcelain required. These improvements are expected to be especially beneficial on extra-highvoltage lines using larger conductors with longer spans and higher tensions.

Ohio Brass Co., Mansfield, Ohio



Lighting Control

Designed for the control of lighting in stage shows, a new system permits a large number of preset lighting arrangements through a series of punched cards. Made during rehearsal through an automatic process, the "punch" cards feed the correct lighting circuit values for a given cue to a lighting system, instantly. Once the set of cue cards for the entire show is made, they are placed in proper sequence in a hopper. During the operation of the show, each cue card is fed into a read-out machine automatically and in sequence to be ready for the next cue. The system consists of three electrically operated units; a manual control console, a card punching machine, and a card reading machine. Thyratron tube, magnetic amplifier, or controlled recti-

fier dimmers are adaptable to this preset system. Cross-connecting. positioning, and color can also be preset using the proper auxiliaries rather than intensity dimmers.

Century Lighting, Inc., 521 W. 43rd St., New York, N. Y.



Time Switch

(10)

Offering minute accuracy in timing operations, a new time switch can be set for from 1 to 24 ON-OFF operations per day, hourly. It can be set for every hour, every second or third hour, on through only once a day. ON periods, of the same duration, may be from 2 to 55 min. Extended accuracy was achieved by mounting a 24-hr dial within a 60-min. dial. Hours when ON operation is desired are scheduled on the 24-hr dial. An OFF tripper, set on the 60-min dial, controls the length of the operation. Rated at 30-amp 1 hp the model No. 4100 is available in both SP and DP. Further details are available.

Tork Time Controls, Inc., Mt. Vernon, N. Y.

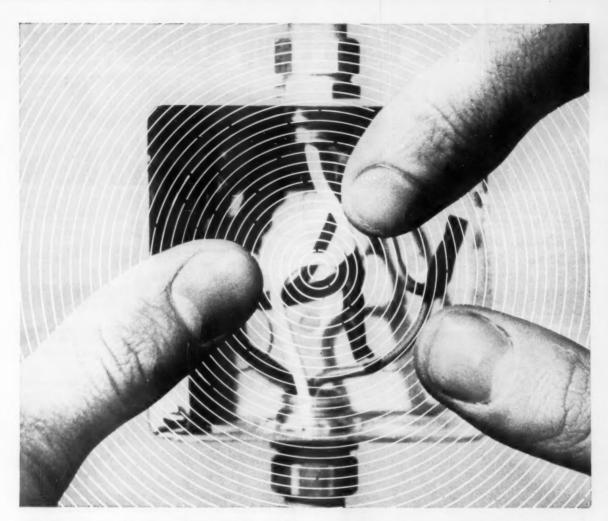


Lighting Fixture

(11)

Featuring a two-tone plastic shield, a new fluorescent fixture, Garlite 101, is available in 1-, 2-, and 4-lamp models, and may be mounted in continuous rows or individually. Extruded in one piece, the shield has sides in diffuse white and a patterned crystal clear bottom which reduces side brightness while allowing efficient down lighting.

Garden City Plating and Manufacturing Co., 1750 N. Ashland Ave., Chicago, Ill.



Take the Thumbs Out of Electrical Wiring With Improved J-M Dutch Brand Plastic Tape

makes every job easier, faster, more economical



Johns-Manville Dutch Brand Plastic Electrical Tape is now made even better! With its improved adhesive, Dutch Brand accomplishes every wiring job with new time-saving nimbleness. Rugged, versatile, it has what it takes to stick around in the "tight spots"—conforming to irregular surfaces neatly without bunching. Important too, Dutch Brand Plastic is now packaged in money saving, economical, convenient 44-foot rolls in addition to the regular 20' and 66'.

See why Dutch Brand Plastic is best for all your wiring assignments . . . Send for "Big Four in Electrical Tapes", the idea booklet that illustrates how you can do better electrical jobs.

Johns-Manville Dutch Brand Division 7800 S. Woodlawn Avenue, Chicago 19, III.

JOHNS-MANVILLE



contractors find: New G-E Plug-in Busway costs



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

H. P. Foley Co.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Columbia Della Section Inc.

West Collingswood Heights, N. J.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Collins Electrical
Construction Co.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Hoffman & Son Inc.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Rosed & Libert



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Bliss & Sage Electrical Malden, Mass.



"New G-E plug-in busway costs les installed than wire ampere rating."

278

J. L. Krauser Co. Portland 14, Oregon

GENERAL ELECTRIC SAYS: Try it - if it doesn't save you



Type DH Busway is rated 100 amperes, 3-wire, single or 3-phase, or 4-wire, 3-phase 600 volts maximum. It serves either as a feeder or plug-in system and may be used indoors wherever exposed wire and conduit could otherwise be applied.

Offer limited to installations made between September 1, 1959 and December 31, 1959. Claims must be received by your distributor on or before January 4, 1960. Offer does not apply to installations made in New York, New York, Newark, New Jersey or the State of California.

Contractors say: "If you can do the job with wire and conduit, we find you can do it now with G.E.'s new 100-ampere plug-in bus-way—and save as much as 25%."

This is not poetic license. This is straight talk about actual dollar-and-cents savings.

Contractors all over the country are echoing this statement and reporting savings of this kind. Some contractors, after learning the facts, have actually switched to DH on the job.

The facts are simple, and to demonstrate them to you, General Electric makes this offer :

- (1) Install, according to G-E installation instructions, 50 feet or more of Type DH busway mounted edgewise on 10-foot centers and where approved by NEC and local codes.
- (2) Compare the total cost of this DH installation with the cost you would have experienced had you purchased and used at the same time heavy-wall conduit and wire of equal ampere capacity. Base your comparison on the use of two or more tap-offs for each 50 feet of run and protective devices that are equivalent in quality and function.
- (3) If the total installed cost of Type DH is more, General Electric will pay you the difference in cash.†

Try DH. You have nothing to lose — and much to gain.

*Example: Suppose DH costs you \$250.00 installed and that you determine an equivalent run of wire and conduit would have cost you \$230.00. The difference is \$20, which General Electric would pay you in cash.

For further details, see your G-E representative or distributor. Ask for Bulletin GEA-6172—or contact Distribution Assemblies Department, General Electric Company, Plainville, Conn.

less installed than wire and conduit!



"New G-E plug-in busway costs less installed than wire and conduit of equal pere rating.

and do

West Electrical Construction Co. Tulsa, Oklahoma



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere ratir

J. C. Cogar Cooper Electrical Construction Co. Greensboro, N. C.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Riddl O'Bu Peifer Electric Co. Trenton, New Jersey



"New G-E plug-in installed than wire and conduit of equal ampere rating."

Brooker Electric Co., Detroit 7, Michigan



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating

2×A

Fisk Electric Co.



"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Loomis Electric Co. Akron, Ohio

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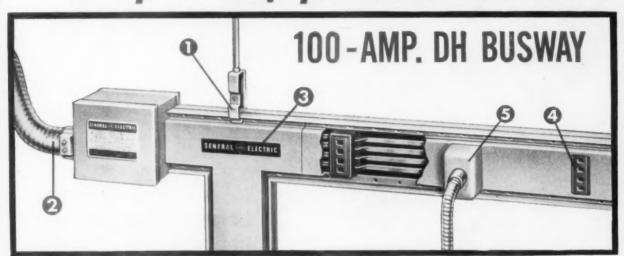


"New G-E plug-in busway costs less installed than wire and conduit of equal ampere rating."

Clarke Lenn

Charles Electric Co. Hartford 6, Conn.

money, G.E. will pay the difference in cash!



Easy to install because:

- nap-on hangers save time.
- 2 flexible fittings and adjustable length eliminate need for exact measurements.
- mechanical and electrical joint connections are made simply by tightening six screws.
- light weight (27 pounds per 10-foot length) and small size make for easy handling.
- approved for mounting edgewise on 10-foot intervals instead of usual five.

· Flexible because:

- 3 standard fittings-both rigid and flexible-allow run to be tailored quickly to virtually any building contour.
- each 10-foot length has 18 outlets, nine on each side.
- lengths can be removed from run without disturbing adjacent lengths.

- ame current rating in ary position.
- 1-, 2-, 3-, 5- and 10-foot lengths.

Safe because:

- a outlets are virtually "dead front" even after covers are removed.
- 6 plugs are totally enclosed and polarized.
- 15.000-ampere short circuit rating standard (100,000 when protected by CLF fuses).
- entire system listed by Underwriters' Laboratories, Inc.

Salvable because:

entire run can be taken down, moved to new locations and re-installed with complete re-use.

Easy to order because:

DH is stocked nationwide by G-E distributors.

GENERAL



ELECTRIC



ENCLOSURES WALL MOUNTED in 18 stock sizes FLOOR MOUNTED. in double door or multiple door units-11

JIC NEMA 12 PANEL

stock sizes.

ENCLOSURES

Ideal for housing electrical controls. components and terminal strips. Note removable mounting panel. Neoprene gasket on door protects against dust,



WIRING BOX

Heavy gauge steel, welded seams. No knockouts or holes to leak oil, water or dust. Neoprene gasketed cover with screw clamp makes tight oil-proof seal. Available with or without removable panel. 8 stock sizes from 4"x 4"x 3" to 16"x 14"x 6".

PUSHBUTTON ENCLOSURES

A complete selection of types and sizes. Fine quality con-struction and finish. Welded seams. Cover Welded seams. Cover has neoprene gasket. Holes take any standard oil-tight pushbutton. Types, range from "Standard" as shown, to Extra Deep, Slim and Pendent. For one to 25 pushbuttons.

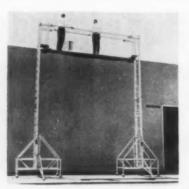




Perfect protection for Perfect protection for control wiring. Neoprene gasket on cover and between joints seals out liquids and dust. Easy to assemble. Full length hinged cover simplifies wiring installation or modification after installation. Stock sizes: 2½*x 2½*x, 4*x 4* and 6*x 6* in lengths up to 10* with Elbows, "T"s, etc.

We also build enclosures to customer specifications

ENGINEERING Mancorporation Dept. ECM-125 Anoka . Minn.

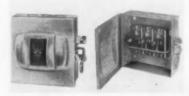


Work Platform

(12)

New 30-ft span bridging equipment has been introduced for use with twin aluminum towers, for assembly of adjustable-height work platforms with vertical clearance over floor obstacles of up to 24 ft. The bridge is installed on the ground, tilted upright, and quickly hoisted to desired height. Bridging equipment locks automatically to towers for any width span up to 30 ft. Entire unit telescopes for rolling under trusses, pipes and other overhead installations, and folds down for rolling through standard 30-in. doorways.

Up-Right Scaffolds, 1013 Pardee St., Berkeley 10, Calif.



Safety Switches

(13)

Designed for commercial and industrial light-duty equipment, a new line of fusible, light-duty safety switches are available in 30 and 60 amps, 240 volts. Available in 2-, 3- and 4-pole, switches feature visibility of all moving parts, compactness with ample wiring space, and ratings listed on the outside front cover of the enclosures.

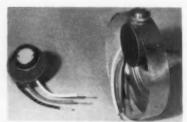
The Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Mercury Vapor Fixtures (14)

A new line of mercury vapor street and highway luminaries, called type M, and a new photoelectric control have been announced. They are available in three basic units: M-250 (175- or 250-watt), M-400 (400-watt), and M-1000

(700- or 1000-watt). The new dusk-to-dawn control has a sensing element hermetically sealed in a special atmosphere for humidity protection and long life, and is plugged into receptacles on the luminaires. Setting of the on-off light level is accomplished by an external screw adjustment on the underside of the base.

General Electric Co., Schenectady 5. N. Y.



Light-Operated Switch

(15)

Rated at 150 watts, 120 volts for tungsten loads, a new light-operated switch is approximately the size of a canopy switch, and may be installed in lighting fixture canopies, outlet boxes, post lanterns, and within magnetic contactor enclosures. Designed to close a circuit at 1 fc, and open at 10, the photosensitive switch has many applications for outdoor lighting, and is installed in an enclosure by drilling or punching a & in. knockout. Various adapters are also available.

Schacht Electric Co., 1213 St. Emanual, Houston 3, Texas.



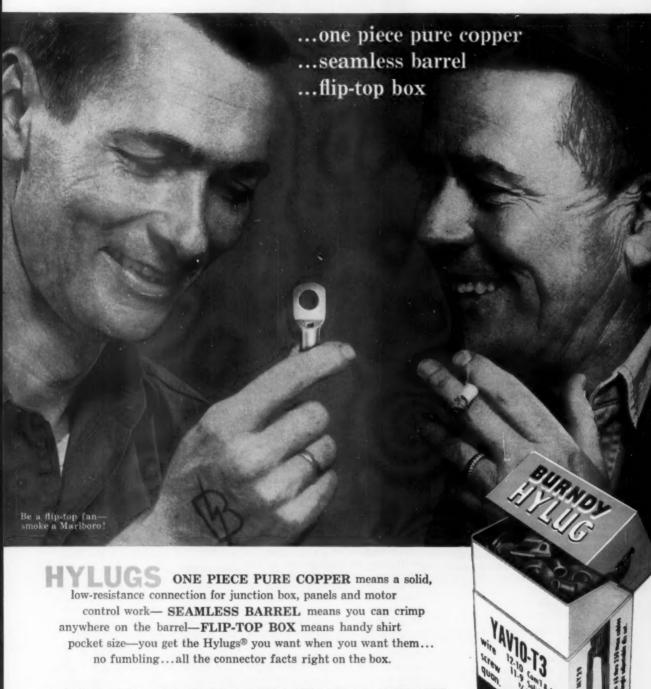
Fixtures

A new "Designer Group" of fluorescent commercial fixtures has been announced featuring 2- or 4-40-watt rapid start lamps for individual or continuous row mounting, either on ceiling or pendant. A one-piece white plastic diffuser totally encloses lamps and features extruded "V" rails on top to firmly engage the chassis and prevent entrance of dust. Wireway covers snap in and out of chassis without Plastic enclosures tools. centered by safety stops to prevent fall-out and chain sets are provided for relamping.

Curtis-Allbrite Lighting, Inc., 6135 W. 65th St., Chicago 38, Ill.

Better makin's

... better packin's!



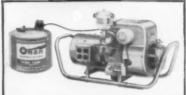
BURNDY

Norwalk, Connect. • In Europe: Antwerp, Belgium • Toronto, Canada

Insist on genuine Hylugs in flip-top boxes!

New 2500-watt Onan Flectric Plant





Special contractor's model; separate 5-gallon fuel tank

Supplies 2,500-watts A.C. . . enough for a crew of three men using electric tools... yet it weighs only 140 pounds!

New separate fuel tank holds 21/2 times as much as regular mounted tank, saves refueling time. Fuel line is quickly detachable. You can move the plant without carrying along

Ruggedly-built : ... quick starting

Powered by a dependable Onan 4cycle, single-cylinder, air-cooled engine. Drip-proof, all-climate Onan generator is directly connected making a compact, rigid, smooth-running power package. No belts or couplings to cause trouble. Aluminum carrying frame, 4 plug-in outlet box, recoil starter and separate fuel tank are standard. Choice of 115, 230, or 115/230 voltages.

> Other models from 500 to 200,000 watts.

Check your phone book for nearest distributor or write for information.



D.W.ONAN & SONS, INC. 3647 University Ava. S.E., Minneapelis 14, Minn.

Load-break Switch

A new frame-mounted, manuallyoperated load-break switch (Type BBS), which incorporates the functions of a disconnecting switch and a circuit interrupter for interrupting transformer magnetizing and load currents, has been announced. The 3-phase switch is available as an unfused or fused arrangement for housing in indoor cubicles, and is offered in ratings 4.8 and 13.8 kv capable of interrupting 400 or 600 amps normal load, and monetary values up to 20,000 and 40,000 amps respectively.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.



Fixtures

Featuring plastic shielded luminaires, a new line of fluorescent fixtures, known as the Achromatic Series, offers the option of 2 or 3 lamps, 4-ft rapid start or slimline, or 8-ft slimline. Units are suitable for surface or pendant, individual or continuous row mounting.

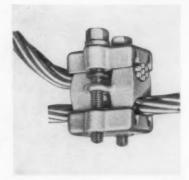
Keystone Electric Manufacturing Co., 2228 E. Tioga St., Philadelphia

Air Dryer

Development of an air dryer for continuous dehumidification of laboratories, test rooms, and small storage areas has been announced. Designed to provide a continuous. low-volume flow of dehydrated air, Model 50 unit has particular application in climatic chambers, drying cabinets, chemical processing, and for storage of paper products. Removing up to 24 lbs of water per 24 hrs, and holding a 10% relative humidity in confined spaces up to 17,500 cu ft, the unit delivers a constant flow of 50 cfm dry air by

alternate utilization of two beds of permanent silica gel drying agent. While one bed removes moisture from air, the other is regenerated by built-in electrical heating elements which vaporize the absorbed moisture and exhaust it outside the dehumidified space. Control is by a hair-element humidistat.

Dryomatic Corp., 806 N. Fairfax St., Alexandria, Va.



Wire Connector

A new all-aluminum 2-bolt con-

(20)

nector is designed for use with copper or aluminum conductors. Made of non copper bearing alloy with anodized aluminum hardware, the connector features a rainshield to prevent washing away of the in-

Jasper Blackburn Corp., 1525 Woodson Rd., St. Louis 14, Mo.



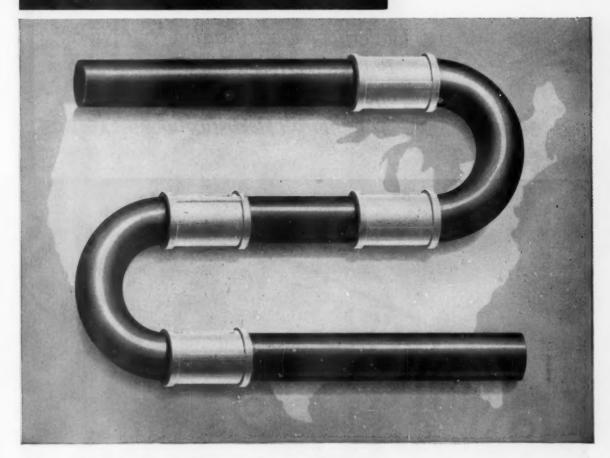
Attic Fan

(21)

Designed for vertical or horizontal mounting, a new attic fan offers 4 different blade diameters; 24, 30, 36 and 42 ins. Fan, driven by a 110-volt ac all angle motor, is mounted in a deep bell orifice in an all steel frame. Ceiling shutters are automatic with double guide bars prevent fluttering and are equipped with fusible safety links.

Meier Electric, 3525 E. Washingington St., Indianapolis 7, Ind.

Naugatuck KRALASTIC



9,000 miles of evidence... KRALASTIC pipe is superior!

Count it by the mile or by the inch, the amount of KRALASTIC® pipe already installed—for everything from drinking water service to salt water disposal, from oil, gas and chemical lines to underground electrical conduit—offers convincing evidence of this superior pipe material's many advantages.

The record of those 9,000 miles of KRALASTIC pipe installed proves KRALASTIC's outstanding virtues. Proves the lasting properties of KRALASTIC. Proves the versatility of

KRALASTIC. Proves KRALASTIC's extreme ease of installation. Proves its ability to take all kinds of weather, from extremes of Tropic heat to the depth of Arctic cold.

Benefit from the experience of the hundreds of users who have proved the unique advantages of KRALASTIC pipe. Investigate this superior plastic piping material yourself. Write for your free copy of the KRALASTIC story—"9,000 miles of KRALASTIC pipe".



United States Rubber

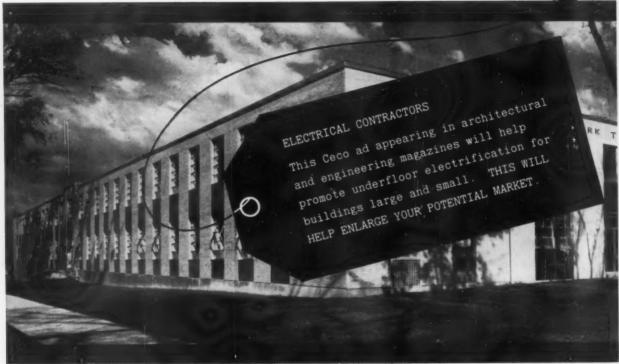
Naugatuck Chemical Division NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS . MARVINOL VINYLS . VIBRIN POLYESTERS

Akron - Boston - Gastonia - Chicago - Los Angeles - Memphis - New York - Phila - CANADA: Naugatuck Chemicals - Elmira, Ont. - Cable: Rubexport, N.Y.

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1959

Underfloor Electrification isn't NEW...
But it's NEWS when a quality system
offers big savings so any building
"can afford" electrification



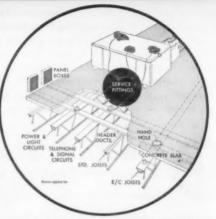


This construction view shows the clean arrangement of header ducts installed on Cece E/C Joints. These header ducts were installed quickly and economically by an electrical craw which had never before installed a system of underfloor electrification.

Electrical, telephone and signal wires are run from the panel board down through the headed ducts, into the top chord of the E/C Joist and up through the service filtings to desks located anywhere on the floor. Whenever desks are moved, the fittings can be installed anywhere along the joist to service the new positions.

The E/C Joist system is listed by

The E/C Joist system is listed by Underwiters' Laboratories for use with standard header ducts and electrical accessories manufactured by General Electric Co., National Electric Division of H. K. Porter Co. (formerly Nepco) and Walker Bros. of Conshohocken.



TOTAL MANUFACTURING FOR THE BUILDING INDUSTRY FROM RAW TO FINISHED PRODUCTS

CECO'S E/C JOIST SYSTEM OF UNDERFLOOR ELECTRIFICATION ASSURES QUALITY WITH ECONOMY



When a building method offers quality at a cost lower than any competing system, that's a combination hard to beat.

Add to that down-to-earth practicality, plus design that satisfies the future . . . then you can specify with confidence.

Such is Ceco's E/C Joist system of underfloor electrification. Savings are realized because Ceco's E/C Joists do two jobs: 1—provide raceways for underfloor electrification; 2—carry the floor load. Now any building "can afford" underfloor electrification.

These advantages of Ceco's E/C Joist system were proved in the Utica, New York Telephone Company office building.

The architect specified Ceco's E/C Joist system and a commonly used alternate. The successful bidder's figures showed the Ceco system saved 56c per square foot compared with the alternate. Read what those concerned have to say:

Owner, Milton A. Abelove and Daniel B. Myers:

"The E/C Joist system satisfied our requirements of avoiding electrical obsolescence for years to come, and we saved a considerable amount of money."

General Contractor, John T. McKay:

"The savings shown in the bids were proven on the job by the Ceco E/C Joist system. I would like to erect more buildings using the same system."

Electrical Contractor, Reginald Keller:

"Installation of the E/C Joist system was practical. Our workmen were able to install it economically, even though they had never installed underfloor electrification using header ducts."

On your next job specify the Ceco E/C Joist system. Send for the facts now. Mail the handy coupon today. Ceco Steel Products Corporation. Sales offices, warehouses and fabricating plants in principal cities. General offices: 5601 West 26th Street, Chicago 50, Illinois.



IN CONSTRUCTION PRODUCTS CECO ENGINEERING MAKES
THE BIG DIFFERENCE . . . Steel Joists / Steelforms / Concrete
Reinforcing / Curtainwalls, Windows, Screens, Doors /
Cecoframe Buildings / Roofing Products / Metal Lath

CECO STEEL PRODU 5601 West 26th Street, Chicago	ECA				
Please send the following techn	ical literature:				
E/C Joist Manual #3011-A	Steel Joist Catalog #3001-0	☐ Joist Load Tables ∤3009			
name					
position					
firm-					
address-					
eltv	zonesta	10			



Cutler-Hammer Three-Star Motor Control is built to take it

If a rifle bullet can't pierce or shatter the Cutler-Hammer Molded Magnet Coil, what chance is there of it being punctured when an electrician's screwdriver slips or of it being damaged when the coil is dropped? If the Cutler-Hammer Molded Magnet Coil is impervious to boiling oil, what chance is there it can ever be penetrated by moisture or distorted by high ambient temperatures?

The strength and durability of these Cutler-Hammer Molded Magnet Coils are but one example of how Cutler-Hammer Three-Star Motor Control is built to take it. Why settle for less when Cutler-Hammer Control costs no more? Specify Cutler-Hammer Three-Star Motor Control...you can be sure it installs easier, works better, and lasts longer.

COLOR-CODED FOR RAPID, SURE IDEN-TIFICATION ... No guesswork for electricians or stock men. Each color signifies the coil's voltage and frequency. Colors are permanent, too, can't rub off.

RED—110 volts A-c, 60 cycle GREEN—208/220 volts A-c, 60 cycle YELLOW—440 volts A-c, 60 cycle BLACK—all other voltages and frequencies



CUTLER HAMMER

Color-Hummor Inc., Milwoukoe, Wis. • Bission: Airborne Instruments Laboratory. • Solidiny: Cutler-Hummor International, C. A.

Air - Intercontinental Electronics Corporation.



Molded magnet coils are standard in all Cutler-Hammer Three-Star Motor Control



NON-REVERSING STARTERS AND CONTACTORS



CONTROL RELAYS



OIL WELL PUMPING CONTROL



REVERSING AND MULTI-SPEED STARTERS AND CONTACTORS



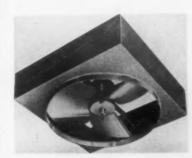
UNITROL MOTOR CONTROL CENTERS



Plug Sets

New single-conductor plugs and receptacles called Supercon electrical connectors are now available in 50- and 100-amp ratings for use with portable or fixed power and distribution panels. Both plugs and receptacles are available in red, white, blue, black, yellow, and green. Pin plugs are assembled by a single nut after cable connection. Receptacles have color-matching caps and bodies to permit ready circuit identification in front and back of panel. Bulletin P259 is available.

The Superior Electric Co., Bristol. Conn.



Attic Fan

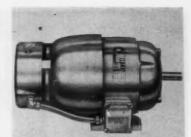
A new 22 in. direct drive attic fan is designed especially for homes with low pitched roofs. With a full 22-in. blade, the square unit measures 24½ by 24½ ins., and can fit over 24-in. o. c. joists. Primarily designed for operation in a horizontal position, unit requires only 30 ins. of ceiling height above the 8-in. deep fan for air flow. It also operates in a vertical position. Equipped with a 2-speed, ½-hp motor, the fan delivers 3400 cfm of free air at 1000 rpm.

The Lau Blower Co., 2027 Home Ave., Dayton, Ohio.

Capacitor Motors

Low cost single-phase two-value capacitor start and run type motors use intermittent duty electrolytic capacitors for both starting and running, and are designed for heavy duty and general purpose applications. The intermittent duty electrolytic capacitor will not be damaged when being constantly energized in the motor circuits at running conditions. Any frequency or standard 60-cycle, 1150, 1750, 3450 rpm motors can be supplied, ranging in sizes from ½ hp to approximately 10 hp.

Lewus Electric Co., 1254 W. Harrison St., Chicago 7, Ill.



Brakemotor

(25)

A new totally enclosed, fan-cooled brakemotor has applications in food processing, metalworking and other industries. A doughnut type magnet in the brake allows the motor shaft to extend entirely through. As a result the same motor can have both a magnetic brake and a cooling fan, totally enclosed and sealed. Using aluminum alloy construction the brakemotors are available in ratings from 1 to 30 hp. Units are also available as a Motoreducer power-package. Drive motors can be squirrel cage, wound-rotor or "Fluid Shaft."

Reuland Electric Co., Alhambra, Calif.



Pedestrian Signal

(24)

(26)

A new pedestrian traffic signal provides "Walk—Don't Walk" messages for street crossings up to 60 ft wide. Unit can be mounted with existing signal brackets, and was designed for use in residential areas and small shopping centers where the streets are narrow. Arrow indicators are also available for multiple-street vehicular indications

Crouse-Hinds Co., Syracuse, N. Y.





Scaffold

(27)

A new line of portable scaffolds are designed for elevated work by mechanical trades in plant maintenance and general construction projects. They are available in extended lengths of 20, 25, 30, and 35 ft. The aluminum tower and platform are raised and lowered by a power unit, controlled by a pushbutton. The power unit is normally supplied in a 110-volt, 60-cycle rating, but can also be supplied in other standard voltages; also for 12-volt operation.

Reynolds Televator Corporation, 1104 Sixth Ave., Muskegon, Mich.



Motors

(28)

A new line of dripproof motors in new NEMA rerated frame sizes. from & hp at 900 rpm through 150 hp at 3600 rpm has been announced. Rigid cast iron frames with integral cast feet also include cast iron endbells having machined registers and bearing fits. Connecton boxes can be rotated to simplify connecting of wires. Aluminum die cast rotors are equipped with dual cooling fans. Also provided with prelubricated bearings, motors can be furnished either 3- or 2-phase, and in all frequencies and commercial voltages below 600.

The Lima Electric Motor Co., Inc., 111½ W. North St., Lima, Ohio.

Right off the Wire

42. A 150-watt lamp only three and one-half inches high is said to give a screen brilliance in a movie projector equal to that of a 750-watt lamp.

83

43. A new electron tube that will go inside a thimble is being made to compete with the transistor.

8

44. Rustproof hub caps for automobiles are being made of fiber-glass.

छ

45. Bulbs can be installed in a new electric light fixture with only a quarter of a turn.

83

46. An inexpensive attachment for any radio sounds an audible warning if radioactive fall-out reaches a dangerous level.

52

47. A giant earth mover, driven by an electric motor in each of its eight wheels can scoop up a fiftyton load in less than two minutes.

8

48. Ultrasonic energy, used in machining hard or brittle metals, can now be transmitted around corners.

82

49. A research camera with 1,200 lenses can take pictures at the rate of 42,000 per second.

8

50. A new diesel-electric locomotive can be switched to third-rail operation without stopping.

8

51. Electric automobiles are in production again. Range on a charge is eighty miles.

83

52. A miniature TV system made for use in a missile weighs only nine pounds and has a range of 1,000 miles.

Maximum s

53. Maximum spark at all engine speeds is claimed for a new transistorized ignition system for internal combustion engines. 54. The first telescope in space is in the plan stage. It would map the sky in ultraviolet light which is blocked by the earth's atmosphere and would be supported by an unmanned orbiting vehicle.

83

55. A proposed atom smasher would be two miles long and eight times more powerful than any now in existence.

83

56. Paraplegics may use a new typewriter in which photoelectric cells are substituted for keys. A lamp on the user's head actuates the cells.

Further information on these news items and on Simplex cable is available from any Simplex office, Please be specific in your requests.

83

57. Aluminum shingles are now being made in a variety of permanent baked enamel colors.

89

58. A new helicopter can carry six tons of cargo.

8

59. A system of harnessing helicopters in teams by the use of metal spreaders has been developed.

8

60. An electric drink mixer that can be used anywhere operates on flashlight batteries.

83

61. A dentist has invented a toothbrush powered by an electric motor.

8

62. The successor to the "Jeep" is a new 1,700-pound vehicle powered by an aluminum, aircooled V-4 engine.

83

63. A New York Bank has installed a clock, powered by a radioisotope, that will run for 200 years without winding.

64. Interchangeable tips for pliers make one tool serve many purposes.

22

65. The Air Force has discovered that submerging a man in water doubles his resistance to acceleration

52

66. A new Army rifle is replacing the Garand. It holds twenty cartridges which can be fired at the rate of twelve and one-half a second.

83

67. Plate glass floated on the surface of molten metal is said to have a better finish than that produced by grinding and polishing.



A NEW MINE— UNDER 50' OF WATER!

Seven miles off the coast of Louisiana, Freeport Sulphur Co. is completing the world's first offshore sulphur mining plant. This unique engineering project consists of a Y-shaped steel island nearly one mile long (the world's largest) erected over a major new sulphur deposit known as Grand Isle.

Supplying power to the drilling platforms and other machinery are Simplex ANHYDREX XX insulated Submarine Power Cables. With a background of forty years' service to the mining industry, Simplex is proud to have contributed to this pioneering project.

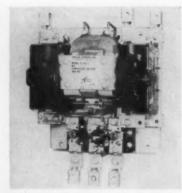
Cambridge, Massachusetts and Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling



PORCELAIN PRODUCTS CO. 225 N. PATTERSON ST. CAREY, OHIO



Magnetic Starter

(29)

Size 4 starter has been added to a line of magnetic starters, and features a new contact structure intended to minimize contact bounce and provide longer operational life under the severe current demands associated with Size 4 applications. Each set of parallel-double break contacts is vertical, dust-tight, nonwelding and sintered; and each utilizes a flexible jumper to provide more points of contact and more available current paths.

Cutler-Hammer Inc., 315 N. 12th

St., Milwaukee 1, Wis.



Transfer Switch

A new automatic transfer switch, featuring an improved arc chute design that provides positive protection of all main contacts, is available in NEMA Size 6. It is electrically operated, mechanically held and is rated for all loads to 600 vac, 250 vdc. Continuous duty current rating is 600 amps. Ratings are the same for all loads and for open or enclosed units. Switch is con-structed with dual coil operating mechanism to give positive action without the need for delicate springs, latches or counterweights.

Zenith Electric Co., 152 W. Walton St., Chicago 10, Ill.

General Electric brings you bold new advances in safety switch design

LINE SHIELD

AFTER WIRING

New G-E light and heavy duty safety switches offer savings in space, easier installation, longer life and maximum safety. And the Heavy Duty (Type A) sells at Normal Duty (Type C) prices! Write for Bulletin CPD-74. General Electric Company, Circuit Protective Devices Dept., Plainville, Conn.

Clear ON-OFF indication,

Visible blades with stainless steel springs assure positive contact; minimum joints in current path; silver-plated current-carrying parts; no fiber linkages to break.

Wire incoming lines at top or bottom. (100-600 amp.) Saves time, work and wire; lets you do a neater job in less time. ON-OFF indication remains unchanged.

Removable cover and interior for easier installation.

Bottom-hinged and front-operated for close ganging. protect personnel from accidental contact.

Safety phase barriers

Lugs for either copper or aluminum. (60-600 amp.)

HEAVY DUTY

GENERAL @ ELECTRIC

O'N OFF



SIOUX ELECTRIC SCREWDRIVERS

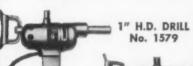
NO. 260 - 262

On No. 260 Super Screwdriver the operator controls the tightness with which a screw is set by the amount of pressure he applies. The ½" Hex Drive takes shanks for clutch head screwdriver bits, Reed and Prince, Standard screws, Phillips, and socket head (Allen Type). On the No. 262 Super Screwdriver tightness is pre-determined by adjusting the clutch. Both models equipped with reversing switch.

NO. 242

It fits the hand, and operates in restricted space like no other electric screwdriver. It quickly drives or removes all types of screws. No. 242 has a positive clutch; the operator controls the tightness by the amount of pressure applied. No. 246 has an adjustable clutch, so that it can be preset for any uniform degree of tightness desired.





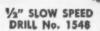




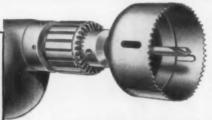












SIOUX HIGH-SPEED STEEL TEETH HOLE SAWS

will cut holes from \%" to 6" in diameter, in any free machining material to a depth of 1\%". Alloy or stainless steel may be cut at slow speed. High-Speed teeth welded to chrome-vanadium body give maximum life and cutting ability.

POWER* SPECIFICATIONS SIOUX ELECTRIC DRILLS

When it's a SIOUX you know what it will do

Catalog Number	No Load Speed	H.P. and		Oz. Ft. Torque at Load Speed	H.P. and at Peak Le	Oz. Ft. Torque Peak Load		
1475	2250	5/64	1525	4.9	7/64	1050	8.8	
1480	1600	7/64	1140	7.9	5/32	790	16.8	
1485	1650	3/32	1060	6.9	1/8	620	16.7	
1495	1650	3/32	1060	6.9	1/8	620	16.7	
1498	400	3/16	275	45.0	9/32	215	108.0	
1510	525	27/64	370	95.0	39/64	230	222.0	
1517	925	13/32	670	49.0	9/16	540	135.0	
1519	1250	13/32	850	37.5	9/16	500	96.0	
1525	1650	5/16	1060	31.0	3/8	680	45.0	
1541	925	13/32	670	49.0	9/16	540	85.0	
1548	525	27/64	370	95.0	39/64	230	222.0	
1550	525	7/16	325	108.0	17/32	175	252.0	
1560	400	9/16	260	175.0	3/4	155	400.0	
1575	400	3/4	205	308.0	1-1/8	125	748.0	
1579	350	49/64	200	315.0	1-9/64	115	800.0	
1472	1600	13/64	960	17.8	17/64	720	32.4	
1473	950	13/64	575	31.6	17/64	430	55.0	
1474	625	13/64	375	44.6	17/64	280	84.2	
1477	950	13/64	575	31.6	17/64	430	55.0	
1478	625	13/64	375	44.6	17/64	280	84.2	
1479	1600	13/64	960	17.8	17/64	720	32.4	



*for complete specifications

SEE THE NEW SIOUX CATALOG

when it's a SIOUX

Wwhatitu

The Horsepower and torque for each Sloux drill is rated, stated, and certified. It isn't necessary to buy just a drill. When it's a Stoux you know what it will do. See the power specifications for Sioux Electric Drills in this advertisement.

Super Yowered 1/4" and 3/8" DRILLS!

Here is super power to provide all the torque necessary for any operation where this type of drill would normally be used. (See specifications) And there's a speed for every need. It's an entirely new design in which the brushes have been located at the fan position at front of the drill. The advantages include cooler running, and easier inspection and replacement of motor brushes without partial or complete disassembly of the tool. Ball and roller bearing construction, with finest precision gears and mechanical design have achieved a new high in output efficiency.



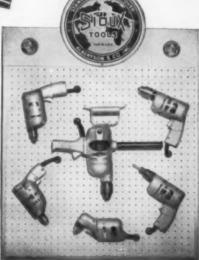
All time sales champ The SIOUX No. 1495 1/4" ALL ANGLE DRILL

Year after year this is a top seller in the SIOUX line. It's popular with almost everyone-auto mechanic, sheet metal worker, electrician, shipbuilder, woodworker, assembly line, factory maintenance man. It fits the hand and operates in restricted space like no other tool. It's a most convenient handful of rugged power.

Leading distributors everywhere display and sell Certified SIOUX power drills. **AUTHORIZED SERVICE** AND DISTRIBUTORS

IN PRINCIPAL CITIES





ALBERTSON & CO., INC. SIOUX CITY, IOWA, U. S. A.

AIR IMPACT WRENCHES . AIR SCREWDRIVERS . "PELICAN" NUT ACCUMULATORS . ELECTRIC IMPACT WRENCHES . DRILLS . GRINDERS . SANDERS . POLISHERS . VALVE FACE GRINDING MACHINES . SCREWDRIVERS . PORTABLE SAWS . FLEXIBLE SHAFTS . ABRASIVE DISCS





3/8" H.D. DRILL No. 1541







1/4" H.D. DRILL No. 1480 SEMI BALL BEARING







A complete new line of power transformers, dry and liquid-filled, are added to this line of equipment. Three-phase substation transformers are available in a range from 112.5 through 10,000 kva, and single-phase units run from 100 through 3,333 kva. Primary voltages are offered to 69 kv. I-T-E Circuit Breaker Co., Philadelphia. Pa. Cable Splice Kit New pre-engineered splice kits

CHAMPION lamps

CHAMPION stands out for VALUE

The last analysis . . . the cost of light . . . is the first concern of Champion . . . where no lamp leaves unless it meets the highest value standards in the industry.

Champion Lamp Works, Lynn, Mass.



(32)

are available for making 2-, 3- and four-way splices. Each contains all the material required for splicing a particular joint. Included in each kit is a housing made from a composition of synthetic rubber and thermoplastic resins. Entrance of moisture is prevented by tight fitting seals and end caps. Catalog JD is available.

G&W Electric Specialty Company, 3500 W. 127th St., Blue Island. Ill.

Voltmeter

(33)

For use in both wet and dry weather, a new "High Line Safety Voltmeter" is designed to measure high ac voltages up to 15 kv. Consisting of a test prod, series resistance, indicating head and a ground lead, the unit may be used with any standard hot stick with a tapped § in.-11 base stud. The voltmeter has two scales of 0-5 kv and 0-15 ky which can be read from 8 ft away.

Western Electro-Mechanical Co., Inc., 300 Broadway, Oakland 7,

Electric Plant

(34)

A direct coupled electric plant, Model E-3500-PDV, provides a continuous output of 3500 watts at 115/230 volts ac. The generator has a self-excited 2-pole revolving armature with inherent voltage regulation. A 4-cycle, one cylinder, air-cooled engine is rated at 61 hp, and is equipped with a mechanical governor. Standard equipment includes 115- and 230-volt receptacles, voltmeter, carrying frame and pushbutton for electric start-

Pioneer Gen-E-Motor Corporation, 5841 W. Dickens Ave., Chicago 39, Ill.



Hydraulic Bender

(35)

A multipurpose hydraulic pipe and conduit bender has been developed to make offsets and 90-deg bends close to the end of ½ to 2-in. conduit with only one setting and one ram stroke. In addition, bends up to 180 deg may be made. Developing 15 tons of ram pressure, the bender can be hand or power pump operated. Casters are furnished with unit, and it can be operated at floor level, or may be set up as a table of any height by inserting lengths of standard pipe in the base as legs, and screwing the casters on the legs. Bulletin E-234 is available

Greenlee Tool Co., Rockford, IU

Motors (36)

A new line of "Recipromotors" for application in the fields of reciprocating mechanisms and automation are designed to operate mechanisms which require many ft-lbs of work per stroke. The moving element or "Recor" is rigid, and the motor may be obtained with two or four stators. Units can be used either for pushing or pulling, or for both.

Trombetta Solenoid Corporation, 329 N. Milwaukee St., Milwaukee, Wis.

Trailer Cord Set (37

A park-to-trailer cable and connector is made exclusively for mobile homes, and the "Life-Line" power supply assembly package consists of a cable hatch, park receptacle, and 25-ft cable. The cable retracts into the mobile home while it is being moved. It is produced in two models, the "50" for 50-amp, 125-volt service, and the "100" for 50-amp, 125/250-volt service.

Hub Industries, Inc., 5410 N. Damen, Chicago, Ill.

FAST Productive CUTTING THREADING REAMING UP TO 2" PIPE OR CONDUIT ALSO BOLTS But, that's not all IT'S RUGGED AND BUILT TO LAST! LOOK . . . • Easy To Transport-Only 180 Pounds • 10 Inches Of Carriage Travel Improved Chuck—No Projecting Jaws You Can Work Within I" Of Face Chip Problem Virtually Eliminated • Coolant Is Directed Automatically On Work With Easy Flip Of Spout Transmission Is Sealed Self-Contained Unit. Easily Accessible. Accurately Cut Helical Gears, Ball Bearing Throughout Spindle Bearings Factory Lubricated Motor—Ample Power, Easily Accessible • Full Visibility To Work • Easy To Read Thread Gauge Write for literature, or . . . Call Mr. TOLEDO NOW! YOUR FRIENDLY DEALER or SUPPLIER TOLEDO PIPE THREADING MACHINE CO. TOLEDO 4, OHIO



Concept in **Motor Control**

URNAS FIECTRIC

This NEW outstanding line of Magnetic Starters features advanced design to assure superior performance and longer life. It reduces parts inventory and provides quick and easy field modification.



Aganet

NEW Dual Voltage 110-220 or 220-440 Volt Coil reconnectable on the job. Magnet features just one moving part.



Thermal Overload Relay

Modification

NEW trip-free Thermal Overload Relays-manual or auto-matic reset. Third overload relay kit can be easily added in the field.



NEW non-tracking Contact Block is impact resistant. Completely visible and front removable silver-cadmium oxide contacts.

WRITE TODAY FOR FREE COLOR BULLETIN 14-B1, featuring Magnetic





Batavia, Illinois.

FURNAS ELECTRIC COMPANY

BATAVIA, ILLINOIS SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES



Limit Switches

A new heavy-duty oil-tight limit switch is offered which can be replaced without disturbing wiring. The new design features a "power plug" which connects the power cable to the switch with a threaded coupling. To replace a switch mechanism, four mounting screws are removed, power cable disconnected, and switch is lifted off. A new factory-wired switch can then be mounted, and power cable reconnected; no wiring being necessary. Bulletin 9007-3 is available.

Square D Co., 4041 N. Richards St., Milwaukee 12, Wis.

Plug Plates

(39)

New receptacle plates are added to a line of low voltage switching devices. They are available in ivory or clear for both receptacles and switches. Featuring a gold tone insert in each clear plate, the card may be painted to match the wall. or used as a pattern for making a wall-paper insert.

Pyramid Instrument Corp., Remcon Div., 630 Merrick Rd., Lynbrook, N. Y.



Limit Switches

Availability of a new 3-circuit limit switch has been announced. "Loxswitch" 3-pole limit switches are made in two models: L100WTR for clockwise operation with two normally open and one normally closed circuits: and model L100WTL for counter-clockwise operation with two normally open and one normally closed circuits. Both switches are readily reversible to give one normally open and two normally closed circuits, and have a 3 in, conduit opening for supply connections. Switch may be used in safety interlock systems to tie together two or three functions without an additional relay, and may be used to control a motor and simultaneously start or stop a timer or other control. 1959 catalog available.

R. B. Denison Manufacturing Co., 102 St. Clair Ave., N. W., Cleveland 13, Ohio

Combination Device (41)

A new combination device incorporates a new "U" grounding receptacle as well as a single pole switch. Grounding may be accomplished through the strap, or by a green hexagonal side screw. The terminal screws take up to No. 10 wire. Switch rating is 10-amp, 125-volt "T", 5-amp, 250-volt. Receptacle rating is 15-amp, 125-volt.

Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza So., Long Island City 1, N. Y.



Control Panel

A new centrally located control panel turns on and turns off lights, heaters, motors, and other devices. It is designed for automatically programmed and manually selected control of coded receivers and dual coded relays. Units are available for electronic operation without special wiring, or synchronous wired operation with system wiring. When operating on four electronic frequencies, it will automatically control as many as 640 circuits. It can be mounted flush or surface.

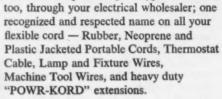
Stromberg Time Corporation, Thomaston, Conn.



.. by more contractors than any other portable cord

The cord that clicks with contractors is ROYAL . . . and the reasons are many. Made to high standards of quality, and controlled every step of the way under one roof, Royal cords offer the quality characteristics that you look for most in your work — flexibility, durability and dependability.

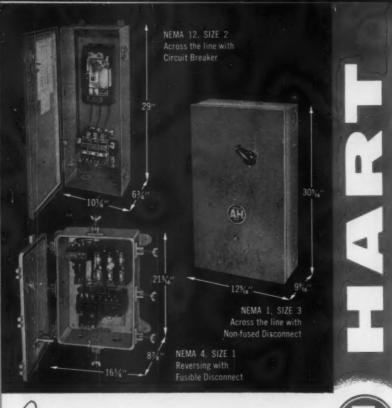
Royal offers the most complete range of types and sizes,



Next time you order cords, specify ROYAL.

Royal Electric Corporation Pawtucket, Rhode Island





ONNOUNCING: A COMPLETE LINE OF COMPACT, LIGHTWEIGHT COMBINATION STARTERS

Sizes 0, 1, 2, and New Sizes 3 and 4—and NEW CAST ALUMINUM WEATHERPROOF and EXPLOSIONPROOF ENCLOSURES

Starters are of exclusive "Right Angle" Design which brings important installation, maintenance and performance benefits. For convenience and safety, unit is front operated by means of Fused or Unfused Disconnect, or Circuit Breaker. Circuit Breakers are Instantaneous or Thermal Magnetic Trip Types. No other line offers enclosures that facilitate mounting and handling like the new cast aluminum NEMA 4 Weatherproof and NEMA 7 and 9 Explosionproof — Enclosures that are one-half the weight of old-style cast iron boxes. Other available enclosures: General Purpose (NEMA 1) and Industrial (NEMA 12 — oiltight and dust resistant).

Write for new folder on A-H Combination Starters to: The Arrow-Hart & Hegeman Electric Company, Dept. ECM, 103 Hawthorn St., Hartford 6, Conn.



MOTOR CONTROLS . ENCLOSED SWITCHES APPLIANCE SWITCHES . WIRING DEVICES



Flush Panel

(43)

(44)

Flush fronts for new 100-amp circuit breaker load centers incorporate a special drawn offset flush front flange. This flange is offset 1 in., which is intended to match the depth requirement for 1 in. drywall installations used over new 3½ ins. deep 2 by 4 lumber.

Circuit Protective Devices Dept., General Electric Co., Plainview,

Conn.

Motors

Low inrush single phase motors to 60 hp are available without objectionable line disturbance characteristics. Capacitor motors operate at a leading power factor. All models are available in drip-proof, totally enclosed, vertical hollow and solid shaft motors, with speeds of 3600, 1800, 1200 and 900 rpm.

System Analyzer Corp., Nokomis,



Electric Plant

(45)

A new 25,000-watt diesel electric generating plant is completely self-contained with a water-cooled diesel engine, "Magneciter" generator, and controls assembled into one unit. Designed for continuous or emergency applications, the prime

mover is a heavy-duty, 4-cylinder, 60 hp, 1800 rpm diesel engine, and the generator is available in all standard voltages to 460 volts.

D. W. Onan & Sons Inc., 2515 University Ave., S. E., Minneapolis 14, Minn.



Blower Fan (46)

Designed specifically for ventilating cubicles, racks and cabinets housing electronic equipment, a new tubeaxial fan is equipped with sleeve bearings and is powered by a 1/70 hp., 115-volt shaded-pole motor. At rated speed the fan will deliver 450 cfm of air at zero static pressure, and 100 cfm of air at approximately 0.22 in. wg static pressure.

American-Standard Industrial Division, Detroit 32, Mich,



Generator Plant

(47

A new 60 kw diesel electric generating plant, Model CD-6018, is a unitized 3-phase, 60-cycle set, with an output of 120/208 volts ac. It has a speed of 1800 rpm developed by a water-cooled 6-cylinder diesel engine, and includes 24-volt electric starting and battery-charging systems. A single enclosed control panel with instruments is also provided. The unit can be used for standby or constant power sources. Other generating plants are available from 3 to 600 kw.

Jeta, Inc., Yonkers, N. Y.



HOW THE ALUMINUM IN

INTERLOCKED ARMOR CABLE SAVES YOU MONEY...SPEEDS YOUR JOB

K/W 3 Conductors Interlocked Armor Cable Spec. 808-S vs. 3 Copper Cdrs. in Steel Conduit

COST AND WEIGHT COMPARISON—1000 FT.

600V RHW 75°C RUBBER 3 Copper Cdrs. In Steel Conduit							600V ALUMINUM INTERLOCKED ARMOR Aluminum Conductors, 90°C, Butyl Insulation						SAVINGS WITH ALUMINUM				
Wire Size	Amps.*	Trade Size In.	CONDUIT O.D. Inches	Area Sq. in.	Total Wt. – Lbs.	Total Cost — \$	Wire Size	Amps.**	O.D. Inches	Area Sq. In.	Total Wt. — Lbs.	Total Cost —\$	% Bonus Ampacity Alum, over Copper	SAVING	S (1)	Weight Savings Lbs.	Space Savings
2	115	11/4	1.66	2.17	2,860	903.	1	120	1.44	1.63	850	713.	4.3	190.	27	2,010	25
1	130	11/2	1.90	2.82	3,570	1,155.	1/0	135	1.53	1.84	960	806.	3.8	349.	43	2,610	35
1/0	150	2	2.38	4.44	4,660	1,457.	2/0	160	1.63	2.07	1,115	926.	6.7	531.	57	3,545	53
2/0	175	2	2.38	4.44	4,960	1,609.	3/0	180	1.74	2.38	1,285	1,093.	2.9	516.	47	3,675	46
3/0	200	2	2.38	4.44	5,350	1,814.	4/0	205	1.87	2.74	1,550	1,265.	2.5	549.	43	3,800	38
4/0	230	21/2	2.88	6.51	7,730	2,508.	250	230	2.04	3.27	1,840	1,522.	0	986.	65	5,890	50
250	255	21/2	2.88	6.51	8,190	2,883.	300	255	2.16	3.66	2,080	1,751.	0	1,132.	65	6,110	44
300	285	21/2	2.88	6.51	8,700	3,171.	350	285	2.27	4.04	2,325	1,870.	0	1,301.	70	6,375	38
350	310	3.	3.50	9.62	10,860	3,752.	400	305	2.37	4.41	2,560	1,998.	-1.6	1,754.	88	8,300	54
400	335	3	3.50	9.62	11,370	4,053.	500	355	2.56	5.14	2,990	2,260.	6.0	1,793.	79	8,380	46
500	380	3	3.50	9.62	12,390	4,748.	600	395	2.79	6.11	3,545	2,615.	3.9	2,133.	82	8,845	36
700	460	31/2	4.00	12.57	15,930	6,459.	750	455	3.02	7.16	4,175	3,151.	-1.1	3,308.	105	11,755	43

1. LESS COST

(1) Savings based on increased cost of copper and steel over aluminum cable.

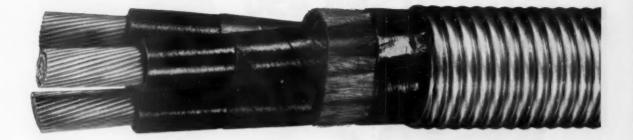
You realize important savings on materials with KW Aluminum Interlocked Armor Cable because (1) it gives you greater current-carrying capacity per dollar, (2) the nature of its aluminum armor eliminates costly conduit. Also, you save on costly labor because KW's corrosion resistant aluminum armor holds upkeep to a minimum, even in highly corrosive areas.

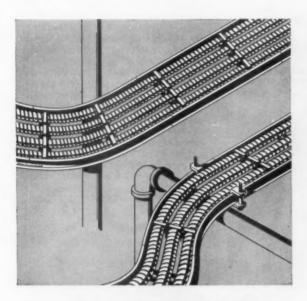
2. LESS WEIGHT

Any interlocked armor weighs far less than heavy, bulky steel conduit. But KW gives you additional weight savings because its armor is aluminum—weighing only ½ as much as steel or bronze. Moreover, because the conductors are also made of aluminum, they are less than half the weight of copper conductors that carry the same amount of current.

Versatile Use. KW Aluminum Interlocked Armor Cable is the ideal answer for industrial and commercial distribution systems, generator leads and auxiliary cable installations.

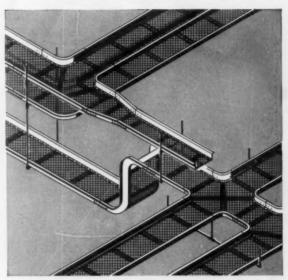
For complete information, call the Kaiser Aluminum sales office or KW distributor listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif.





3. FASTER INSTALLATION

The light weight and supreme flexibility of KW Aluminum Interlocked Armor Cable mean easier handling, cut installation time in half. It can easily be bent horizontally or vertically around impeding objects and laid in longer lengths, eliminating the need for frequent splicing. In addition, because its diameter is less than conventional conduit systems, compact KW cable can bring space savings of up to 54%.



4. SPEEDIER MODIFICATIONS

KW Aluminum Interlocked Armor Cable may be laid on readily accessible racks, trays and troughs . . . or hung from a messenger. It is a quick and simple matter to expand KW Interlocked Armor Cable systems to meet increased power requirements which may arise after installation.



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Portable Tristand Chain Vise



Here's a real time saver. Not only do you get a complete workbench that's truly portable, but now you get a chain vise that's extra easy and fast to operate. Handle is right up on top where it's always handy. Handle and tightening nut are anchored to

vise base . . . can't pull out.

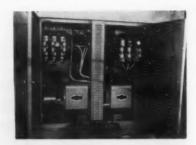
Vise base, that overhangs front legs for clear tool swing, has hanger slots for tools, 3-size pipe bender, rear pipe rest and adjustable ceiling brace screw. Folding legs and integral tray set up easily and lock in position for rigid work base. Snap chain holds folded legs closed for easy carrying . . . no loose parts. Rubber grommets in tristand feet prevent creeping. See and try this more-for-your-money represents the screw Chain Vise at your Supply House!

New RIDE Bench Chain Vises

5 Sizes for 1/4" to 8" Pipe, Conduit or Rod



The Ridge Tool Company, Elyria, Ohio, U.S.A.



Frequency Converter

(48

Packaged frequency converting systems have been added to this line of motor-generators. A sheet metal housing contains all necessary switchgear for both motor and generator with the converter mounted on a structural steel base as an intricate part of the base of the cubical. The 60 to 400 cycle frequency converter has an output of 30 kw when operated at 3428 rpm. 3-phase, 120 volts, and the rating of the 60 cycle squirrel cage induction motor is 45 hp, 208 volts, 3phase, with part winding for starting. Six lead wires have been brought out from the generator to permit wye connection of either 120 or 208 volts, or 120 volts single phase connection with up to 20 kw output. The nine wire motor can be reconnected for 416-volt operation. Form DC 459 Bulletin avail-

Kato Engineering Co., Mankato,

Automatic Light Control (49)

A new automatic light controller regulates lighting like a thermostat controls heat. Developed primarily for schools, offices and factories, the system measures the amount of daylight entering a room, and dims or brightens light to any level preset on the regulator. Economical operation and uniform lighting levels are design objec-

The Superior Electric Company, Bristol, Conn.

(50)

Connectors

tives.

Color-keyed connectors compatible with either copper or aluminum conductors, and for installation by a new lightweight hydraulic tool which delivers 12-ton force, have been introduced. Tool installation range in the series is from No. 12 aluminum or copper to 750 MCM aluminum or copper. Connectors are also supplied in sizes to $2\frac{1}{2}$ million MCM. Proper installation die is selected by matching its color

with that on the connector to be installed. Die halves are then handinserted into the tool. New connector line includes terminals (1, 2 or 4 bolt holes), 2-way connectors, taps (twin and parallel) and reducing connectors for reducing aluminum to copper of equivalent current carrying capacity.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.

Heaters

(51)

Series 100 bathroom radiant heaters have been introduced in three versions. There is a 1.000watt unit, switch controlled, a 1,000watt unit themostatically controlled, and a 1500-watt unit thermostatically controlled. All are 120-volt heaters that mount flush in the wall. Ribbon type elements provide instant heat. One version is available in the series 200 fan-forced line. It is a 1500-watt heater controlled by a thermostat. It also operates on 120 volts. Five different units are planned in the heavy-duty fanforced series 300. One, operating on 120 volts, will have a 1500-watt capacity. Others, all operating on 240 volts, have 1500-, 2000-, 3000and 4,000-watt capacities.

Arvin Industries, Inc., Columbus, Ind.



Hot Water Boiler

(52)

New electric hot water heating boiler is designed for radiant panel, convector, baseboard and radiator type heating systems. Coal, oil, or gas-fired hot water systems can be converted easily. Boiler supplies hot water at temperature ranging from 60 to 200 degrees-is suited for new or old homes, motels, churches, commercial buildings and swimming pools. Unit can also be used with water chiller for yearround air conditioning. It is now available in sizes from 40,948 Btu to 2.047.200 Btu. Literature is available.

Precision Parts Corp., 400 North First St., Nashville 7, Tenn.







Catalogs & Bulletins

- (53) STEEL CONDUIT. 8-page catalog RSC-559 describes Dualcote rigid steel conduit, couplings and elbows, including discussion of corrosion problems. Walker Bros.
- (54) MOTOR STARTERS for irrigation pump motors. Bulletin GEA-6946 discusses manual squirrelcage starter for reduced-voltage starting of motors rated 150 hp, 220 volts, and 300 hp, 440 or 550 volts. General Electric Co.
- (55) AIR CONDITIONERS. 8-page Bulletin 9127 describes line of lowpressure Inductor air conditioners for perimeter air conditioning of multi-room buildings. American-Standard Industrial Div.
- (56) STREET LIGHTING CONTROL. Bulletin GEA-6987, 4 pages, describes new cadmium-sulphide photoelectric control for dusk-to-dawn operation of street and highway lighting circuits, General Electric Co.
- (57) Service Equipment. 12-page booklet covers complete line of facstory-assembled fusible entrance equipment rated 30 through 200 amps. Cutler-Hammer Inc.
- (58) ELECTRIC CODE GUIDE. Sturdy wall-size oil- and grease-resistant plastic sheets contain tables from the new NEC giving such information as number of conductors in conduit and tubing, conductor carrying capacities, motor overcurrent protection, and motor full-load current. Columbia Cable and Electric Corp.
- (59) EXPLOSION-PROOF MOTORS. Bulletin GEA-6974, 2 pages, lists advantages, applications, types, and characteristics of dc continuous mining motors. General Electric Co.
- (60) STRAIN RELIEFS for eliminating cord failures where cord enters equipment are discussed in 4-page bulletin. Three types—all metal click-on, and insulated—are illustrated and described. George Walker Co.
- (61) LIGHTING FIXTURES. Catalog 650, 16 pages, features full-color illustrations and drawings of pull-down bubbles, opal glass clusters, chandeliers, post lights and kitchen fixtures. Thomas Industries, Inc.

(62) SPLICES. New bulletin describes simplified method of installing service entrance connections without the use of tape or a "third hand." Standard compression tools and Insulink connectors for copper and aluminum cables are used, from No. 10 stranded through 1/O and from No. 6 through No. 2 ACSR. Burndy Corp.

(63) FLOODLIGHTS. Bulletin GEC-1487B, 6 pages, describes line of Fluoroflood fluorescent floodlights for billboards, loading areas, highway signs, service areas, building fronts and sports areas. General Electric Co.

(64) ELECTRIC EYES for process industries. Bulletin 522 covers both usual and unusual installations that have been made for monitoring of process flows using electric eyes. Photomation, Inc., 96 S. Washington Ave.

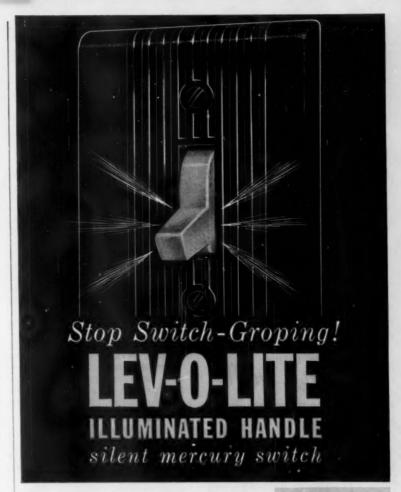
(65) WELDING. 8-page article reprint Form ADR 121, "Which Welding Power Source Should You Use?" provides a guide to the proper selection of one of four basic types of power sources, taking into consideration such things as type of current, machine characteristics, welding duty cycle, and available supply voltage. Air Reduction Sales Co. Inc.

(66) AUTOMATIC CONTROLS for heating, refrigerating and air conditioning. 1959-1960 catalog, 56 pages, includes such new products as low-voltage thermostats of new design, a variety of electric heat controls, and combination zone control packages for both warm air and hydraulic systems. White-Rodgers Co.

(67) Wire Terms. 4- by 6-in. pocket-sized booklet alphabetically lists common terms, expressions and units used in the electric wire and cable industry. Standard Wire and Cable Co.

(68) SIGNAL CONTROLS. Bulletins 250, 251, 252 and 253 describe line of controls ranging from single-circuit flashers to custom-built multi-circuit units for scoreboards, color changers, etc. Signatrol Inc.

(69) CONTEMPORARY LIGHTING. New architects' and designers' folio of commercial and ecclesiastical lighting designs show contemporary fixtures along with matching units for subsidiary areas. NL Corp.



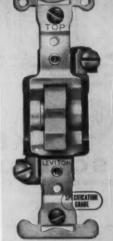
No longer any need to fumble in the dark when looking for the light switch... no more dirty walls from groping for the switch. The answer? Lev-o-Lite with a tiny built-in neon light that illuminates the switch handle, costs only a few cents annually to operate and lasts a lifetime. The switch is sturdy with no moving parts to wear out, no springs to snap and as easy to install as any standard switch. Ideal for that dark spot—and silent too.

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DISTRIBUTORS IN PRINCIPAL CITIES

- (70) MERCURY LUMINAIRES. Bulletin GEA-6943, 12 pages, describes new line of mercury units for roadway lighting rated at 250, 400 and 1000 watts. General Electric Co.
- (71) POWER SYSTEM. Bulletin 21-200, 6 pages, explains inverter-diverter continuous ac and dc standby power system that changes immediately from normal to emergency operation. Electric Products Co.
- (72) BATTERIES. Technical brochure "The Battery for You" discusses long-life silver-cadmium Silcad cells, giving physical and electrical characteristics. Yardney Electric Corp.
- (73) SWITCHING CENTERS. 20-page Bulletin G-1616-A describes the selection and specifying of 4.8 through 14.4-kv power switching center equipment using building block concept of standardized metal cubicles, I-T-E Circuit Breaker Co.
- (74) TECHNICAL WRITING. 50-page manual, Writing and Publishing Your Technical Book, answers questions on organizing and developing ideas, preparing material for publication, and author-publisher relationships. F. W. Dodge Corp.
- (75) SLIDE-RULE CALCULATOR quickly shows how many capacitor KVAR of correction are needed to raise existing circuits to meet minimum power factor requirements. Form AD-188. Sprague Electric Co.
- (76) SNAP-ACTION SWITCHES—ideas to increase production efficiency. Drawings and photos illustrate six methods of saving manhours and eliminating waste, Micro Switch.
- (77) HEAT CONTROL. Data sheet describes unit for regulating electric heating appliances or units to close tolerances, Industrial Steam Equipment Co.
- (78) INTEGRATED CEILINGS. Data sheet presents results of study, describing type of ceilings and ceiling tile, installed labor and material costs of lighting and ceiling plus applications for each type of system. United Lighting & Ceiling Co.
- (79) FLAME CONTROL. 4-page bulletin describes combustion safeguard control for heating and heat-treating applications, providing numerical indication of faulty burner position. Protection Controls Inc.

- (80) HANDLING TOOL fittings for high-voltage (2500 volts and up) power fuses, cutouts, switches, and load-interrupters are featured in 12-page selector guide, Bulletin 823. S&C Electric Co.
- (81) SCREW ANCHORS, toggle bolts, masonry drills, wire connectors, and conduit straps are described in 6-page bulletin which includes a free kit. Holub Industries Inc.
- (82) STARTERS. Bulletin GEA-6860, 8 pages, defines, tells when and where to use, and how to select reduced-voltage motor-starting equipment. General Electric Co.
- (83) AC GENERATORS. Nine spec sheets cover 18 different models of standard line to 250 kw. Kato Engineering Co.
- (84) POWER SUPPLY. Bulletin V359, 4 pages, describes the adjustable Varicell, providing ac outputs up to 50 volts, dc up to 60 volts from a 240-volt 3-phase input. Superior Electric Co.
- (85) Underfloor Wiring. 4-page Bulletin 692 describes two new Headerduct systems for use with cellular steel floor construction. National Electric Div., H. K. Porter Co. Inc.
- (86) CAPACITORS. Bulletin 32B9421 describes construction features of substation and pole-mounted power factor capacitors rated 25 and 50 kvar. Allis-Chalmers Mfg. Co.
- (87) BRUSH MAINTENANCE manual for low-voltage generators, 16 pages, contains practical tips on brush operation and maintenance on high-current, low-voltage machines used in electrolytic processes. National Carbon Co.
- (88) TROLLEY BUSWAY for cost reduction on assembly and production lines. Bulletin 73 shows examples of usage to insure dependable operation of electrical tools in industry. Feedrail Corp.
- (89) PLATING RECTIFIERS. Bulletin 100 describes line of selenium, germanium, and silicon rectifiers rated to 500 kw, with or without full automatic control. Djeco Div., Djordjevic Engineering Co.
- (90) BRUSHLESS GENERATORS. Synchronous units in 40 to 300 kv capacities which utilize a combination of brushless excitation and static voltage regulation are described in Bulletin 51B9192. Allis-Chalmers.

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slow: Actual size photograph of clear plastic lens.

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If your customer needs approximately 50 footcandles, install one Prismatic for every 40 square feet of area. Suggest to your customer that he paint his ceiling white and his walls a light color.





Takes two Rapid Start lamps. Installs easily directly on the Have you seen it yet? It will surprise you. For the Wakefield Jefferson CBM/ETL, HPF ballast. IBEW, UL/CSA labeled. Prismatic is a quality fixture through and through. Graceful one-piece clear plastic lens diffuser. All steel parts white enameled. ceiling, singly or in continuous rows.

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Fear out this page—it's per-forsted for your convenience.

Pulley Centers

QUESTION K36—What is the approximate rule for the minimum distance between pulley centers for open belt drives from small electric motors?—G.J.P.

ANSWER TO K36—For speed ratios less than 3 to 1, center distance can be one-half the sum of the sheave pitch diameters plus the pitch diameter of the small sheave. For example, if an 8-in. and 4-in. pulley are used; 8 plus 4 over 2 plus 4 equals 10-in. center distance. For speed ratios of more than 3 to 1, the center distance must be at least the diameter of the large pulley.—R.M.

ANSWER TO K36—The proper application of belt drives is rather complex and is contingent upon the nature of the load, type of driving unit, horsepower to be transmitted and speed

The nature of the question is such that the above does not appear to be a consideration, therefore it was submitted as a reminder of the full scope of belt application.

There is an approximate rule for determining the minimum distance between pulley centers. It is based on 165° arc of contact of the driving pulley. For small electric motors: C = (D-d) 3.5, where C = distance between pulley centers, D = diameter of larger sheave, d = diameter of smaller sheave. Where C is equal to or less than 1/2D + 1/2d, pulley sizes have been improperly selected.—J.A.M.

Flywheel Design

QUESTION L36—We plan to install a heavy flywheel between motor and generator of traction system to smooth out peaks. Being a dc load we have no problem with variation in frequency, only voltage. The sags are produced by heavy coal trains starting in mine grades. Is the following the proper equation to use to solve the problem?

$$\mathrm{WR^2} = \frac{130~\mathrm{KW~Z}}{\frac{(\mathrm{rpm})~3}{100}} \times \frac{\mathrm{A^2}}{\mathrm{A^1}}$$

-T.H.A.

ANSWER TO L36—There is more to this problem than any "rule of thumb" or simple equation into which to plug a few values.

In order to be effective, the energy stored in the flywheel must be

much larger than that required to accelerate the ore train. Assuming a drop in M-G set speed of 20% is acceptable during acceleration of the train, the flywheel will give up 1º-0.8º or 36% of its energy. In order to allow the flywheel to accelerate the train and the drive motor supply the losses and friction load, the flywheel must store nearly three times as much energy as the train requires for acceleration. If the train is supplied from an (essentially) constant voltage M-G set. and started with a current limit step resistance controller, the acceleration control must dissipate as heat as much energy as the train requires for acceleration, and the flywheel must store six times as much energy as the train requires. Such a flywheel will weigh several tons in a practical case, and is not something which may be added to equipment which was not designed for it.

The question does not state whether the voltage problem occurs on the ac supply to the M-G set drive motor or the dc output of the generator. Provided the drive motor is a wound rotor machine with suitable secondary resistance controls, a flywheel can be very effective in limiting the power and voltage swings on the ac line. However, if the M-G set is the more common variety with a low-slip squirrel cage drive motor, a flywheel is of no use if it is desired to limit the magnitude of the power demand on the ac line. In case the problem is to limit the rate of rise of power demand on the ac line, so that an ac voltage regulator may have time to compensate, a relatively small flywheel can be quite effective. In this case the flywheel size is determined by the maximum WRs which the motor may accelerate. This figure can be obtained from the motor manufacturer. It should be remembered that an amount of energy equal to the energy stored in the flywheel at full speed must be absorbed and eventually dissipated by the squirrel cage motor rotor when starting and accelerating the M-G set and its flywheel. Reduced voltage starting does not alter or improve this relation in any significant way.

A flywheel is of no use if the problem is voltage regulation of the dc output of the generator. The speed regulation of a squirrel cage motor up to twice full load is insignificant in its effect on a (separately excited) generator. If dc voltage is the problem, what is needed is a field forcing regulator and an exciter system with a high coefficient of response. If your exciter is belt driven, some improvement may be effected by changing sheaves so as to speed up the exciter. This permits adding resistance in the generator field during normal operation, and providing relays or regulator circuitry to cut out this resistance when the acceleration load comes on. For maximum response, even with present equipment, all possible manually adjustable resistance should be cut out, so the regulator may throw essentially all field resistance out of the circuit when the load comes on, giving a measure of field forcing. An old fashioned alternative would be to intall a direct connected series booster in the generator leads. This is essentially a series "motor" driven as a series generator by an induction motor, which acts the same as a compound field on the generator. Do not use a belt drive, and do not forget to install an overspeed shorting switch if a booster is to be used. A rototrol or amplidyne exciter would be a better solution.

It is easy to assume unsatisfactory performance of electrical equipment if due to voltage drop. If the locomotive is (or was intended to be) the only load on the generator, voltage drop has no effect on train acceleration (assuming current limit locomotive controls) other than to improve the efficiency. A generator whose voltage starts near zero and gradually builds up as the locomotive accelerates (and requires more voltage) will accelerate the train at an efficiency of 100% less the locomotive motor and generator losses. A constant voltage generator will accelerate the train at an efficiency of 50%, less the same losses. There is no difference in performance, except of course the first case gives much smoother and a little faster acceleration. It is quite possible the original designer built voltage drop into the generator on purpose, to improve the efficiency.

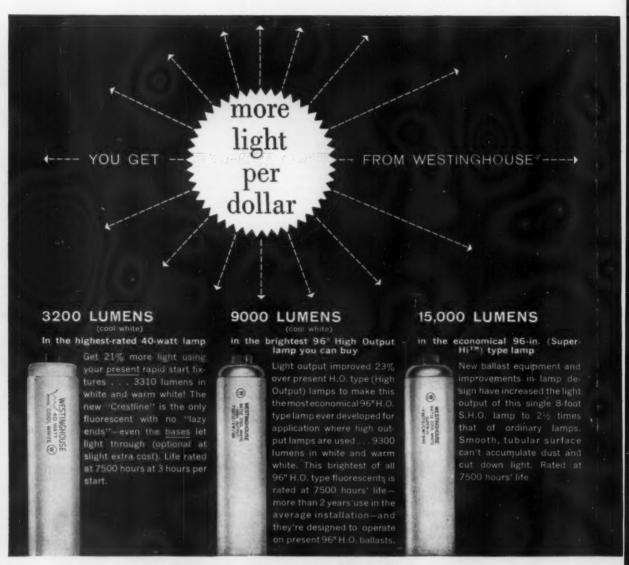
Just in case the question does concern a wound rotor motor, does concern the ac supply voltage, and the shaft and the bearings on the M-G set permit installation of a flywheel, the following equation may be use-

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job that two different types have been doing!

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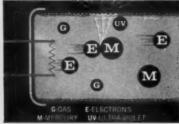
Simplify stocking, ordering and maintenance by specifying this one 40-watt fluorescent lamp for the job that two different types have been doing! The new Westinghouse "Universal" lamp can be used on either your present rapid start or preheat circuits with no loss in lumen output. You'll save storage space; save time and error in maintenance by stocking this one lamp.

Whether you're planning or expanding, you can use this lamp in your new fixtures, as well as in your existing ones. And here's the best news of all: light output has been increased to 2800 lumens, while the list price has been reduced to only \$1.25—5¢ less than old style rapid start lamps!

Only Westinghouse brings you these 6 LIGHT-BOOSTING ADVANCES



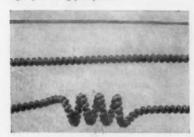
UltralumeTM Phosphors: Westinghouse research has proved that the size of the individual phosphor particles which coat the inside of a fluorescent lamp have a direct effect on the amount of light given off. Now, a new and exclusive Westinghouse process selects the right particle size for more efficient light-producing phosphors.



Mixed Gases: All fluorescent lamps contain mercury and gases. The gases serve as conductors until the mercury is vaporized. These gases and mercury vapor then convert electricity into ultra-violet radiation, which causes the phosphors to "fluoresce." Westinghouse uses the right mixture and pressure for each type of fluorescent lamp.



Plated Leads: The electron bombardment inside a fluorescent tube eventually causes particles of the metal supports and leads to sputter off causing "end blackening." To prevent this, Westinghouse plates the lead wires with super-hard chrome-vanadium. Result: tubes that stay brighter, end to end.



Triple Colled Electrodes: Westinghouse uses triple wound electrode coils to hold the right amount of emission material. This carefully measured amount is heated quickly and adequately protected from bombardment to insure long life and trouble-free starting.



"Custom" Anodes: Anodes act as buffers and prevent excessive "sputtering" of emission material from the electrodes. Since the electrical characteristics are different for each type of fluorescent lamp, Westinghouse anodes are especially engineered to fit the electrical requirements of each type of lamp.



Silicone "Raincoats": In high-humidity areas, moisture can collect on the exterior surface of the lamp and prevent it from starting. To protect against moisture accumulation, Westinghouse fluorescents are given a special Silicone coating, or "raincoat," which disperses this film into harmless droplets.

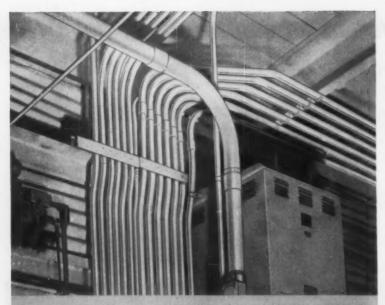


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For more information

and names of Reynolds Aluminum Electrical Rigid Conduit outlets, call your nearby Reynolds Sales Office or write Reynolds Metals Company, Box 2348-ET, Richmond 18, Virginia.

Also write for descriptive brochure.

Watch Reynolds TV shows - "ALL-STAR GOLF" and "ADVENTURES IN PARADISE" - ABC-TV

ful. Differential equation of motion (all quantities reduced to per unit): $T = J du + T_L$, where T = motor

$$\underline{\text{torque}} = \frac{\text{(HP) (550) (60)}}{\text{(rpm) (2 \pi)}} \begin{bmatrix} 1 - S \\ R \end{bmatrix}$$

ft lbs/base torque.

T_L = Sum of acceleration, grade and friction load on locomotive drive and any other load referred to generator shaft; ft-lbs/base torque.

Base Torque =
$$\frac{\text{(HP) (550) (60)}}{\text{(FL rpm) } 2\pi}$$

ft pounds (with zero external rotor resistance).

$$J = \frac{WR^2}{32.2}$$
 slug ft^2 /base torque.

R= per unit motor resistance including internal. (R=1.0 results in rated torque at zero speed. For squirrel cage motors

$$R = \frac{Synchronous rpm - FL rpm}{Synchronous rpm}$$

 $W_o = \text{speed at } t = 0$. (if machine carries an initial load, $W_o = 1 - (R)$ (T initial), where T initial is in per unit) $u_1 = \text{synchronous speed}$;

$$u_1 = 1.0$$

 $W_{\text{d}}=$ steady state speed of motor which would result if T_{L} continued indefinitely; $u_{\text{d}}=1.0~(T_{\text{L}})~(R).$ $W_{\text{s}}=$ speed at which desired ac current limit is reached,

 $W_s = 1.0 - (I)$ (R), where I is per unit current, say 1.25. (That is, perhaps 1.25 x full load).

The solution is:

$$T = \mathrm{JR} \, \mathrm{lu} \left(\frac{\mathrm{W_0} - \mathrm{W_d}}{\mathrm{W_0} - \mathrm{W_d}} \right)$$

This expression gives the time in seconds for the M-G set to decelerate from W. (say 1.0 or 0.998) to W. (say 0.97) with a given value of R (say 0.02). The result, t, will not equal the acceleration time of the train-choose a new value of R (corresponding to addition of the first resistance step on the rotor current control), take a new u_o = 0.97, choose a new u2 consistent with the current limit, refigure u with the new R, and find the time t, on this step. Repeat this process until the sum of t1, t2, t2-ta equals the acceleration time of the train. You will find this is a cut and try process limited by the number of resistance steps in the rotor secondary, the size of the steps, the WR2 of flywheel and M-G set, and the practical speed drop, say to 75% speed. The dc generator exciter may place a limit on the allowable speed drop, the generator must be separately excited and have its own drive motor order to avoid exces-

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sive dc voltage drop. Note that the logarithm in the solution is the natural logarithm, to the base e (e = 2.718, not 10).

It is just not possible for me to give a better answer to this problem without knowing such things as the weight and horsepower of the locomotive, present acceleration time, desired time, allowable ac or dc voltage drop, present fluctuation. size and speed of M-G set, type drive, excitation, and voltage regulator, type controller and both the locomotive and (wound rotor) drive on the M-G set, and other details. Flywheels are proposed more often than they are used. I suspect your equation was misprinted; A²/A¹ = A. which seems to mean very little. especially when one doesn't know what A is. The expression is vaguely familiar, but I do not recognize it. The stored energy of synchronous machines per kva is H = kw-seconds/kva =

 $\frac{30}{130} \frac{(WR^2) (rpm)^2 \times 10_d^8}{kva}$

-R.L.M.

Threaded EMT

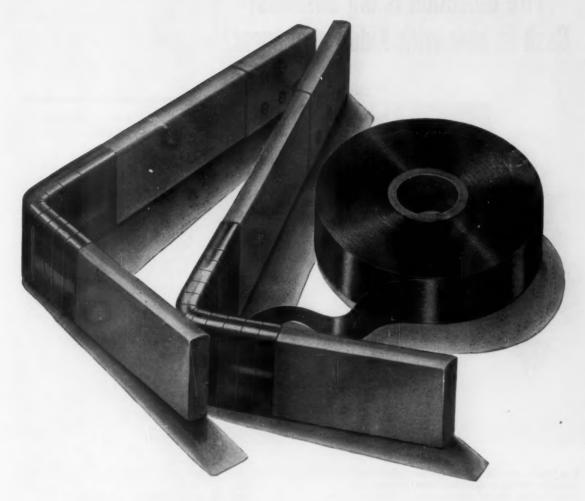
QUESTION N36—The N.E. Code allows threaded electrical metallic tubing for wiring in a Class 1, Div. 2, hazardous area, provided it complies with Section 3487 of the Code.

Has any reader used threaded EMT, and what company makes threaders and fittings?—W.E.G.

ANSWER TO N36—We have had some interesting discussions and interpretations on the above wiring method. The outcome of these discussions led us to ask for a ruling on "Threaded Electrical Metallic Tubing" from Mr. C. M. Park on NEC Panel No. 14. Following is the explanation we received:

"At the time the text of Paragraph 5014b was adopted there was on the market a line of fittings to which the electrical metallic tubing was connected by threads. These were fine shallow threads, and were supplemented by a tight fitting sleeve to avoid bending stress in the threads themselves. Subsequently, this line of fittings was taken off the market and they have not been available for several years. Panel 14 recognized this situation in the preparation for the forthcoming 1959 edition of the NEC, and reference to electrical metallic tubing in 5014b has been deleted in the new code."

As for myself, I have never seen



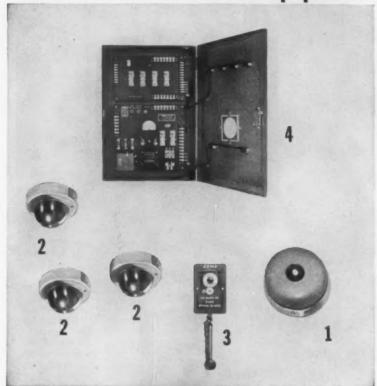
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either threaded EMT or any of the fittings.—C.O.D.

Editor's Note. Interim amendment No. 109, effective July 18, 1958, deleted the use of threaded EMT as a permissible wiring method in Class I Division II locations (Section 5014-b).—J.W.

Can You Answer These QUESTIONS?

QUESTION W36—We have a problem which I am sure many other contractors have and that is a way to keep or store temporarily short lengths of wire and broken coils.

We find it pretty hard to get our electricians to use up short pieces of wire before opening new coils.

We would like to find out what others are doing along this line.—A.M.S.

QUESTION X36—The starting current in a 3-phase squirrel-cage motor is equal to the applied voltage divided by the equivalent impedance. This, then, is the maximum current that can flow in the motor. Yet, authors claim that during plugging, the current far exceeds this value. How is this possible?—J.A.M.

QUESTION Y36—We are to install a 750 kva oil filled outdoor transformer just outside the plant wall. Are there any code provisions or standards for minimum separation between transformer and building wall; or restriction as to openings or windows in the wall?—A.W.C.

QUESTION 236—Is there a simple method of arriving at the current interrupting capacity required in current protective devices for a given installation?—P.S.K.

QUESTION A37-At the plant where I am employed, there is a considerable amount of electronic control equipment. Some of the manufacturers are using transistors in their type of control. Is there any sure method of testing transistors and making repairs of this type without sending them to the manufacturer? Can a standard type voltmeter, ammeter, multimeter or oscilloscope be of any help in doing the above job? If the above instruments are not suitable, please suggest a more adequate means .- M.D.

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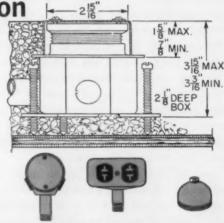
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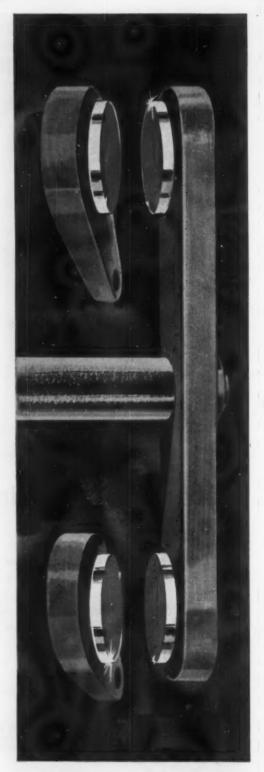


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ONLY the C-H 4151 has solid silver double-break, butt-type, vertical contacts. Silver, long standard in industrial control, far outlasts contacts of copper or bronze. The double-break contacts cut arc voltage in half, further lengthening contact life. There's no scrape or slide when these face-to-face butt-type contacts close . And vertical construction sheds dust, keeps the contacts clean.

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Questions on the Code

Answered by:

B. A. McDONALD. New York Board of Fire Underwriters, Rochester, N. Y.

B. Z. SEGALL, Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.

R. E. WARD, Consulting Electrical Engineer, New Orleans, La.

Four-Wire Delta Service

Given a building served by 120/240 volts, 3-phase 250 mcm copper service entrance required for single phase load. No. 6 power leg would be adequate for service entrance to serve small 3-phase load in this building.

Should four 250 mcm service entrance conductors be required for this building or would three 250 mcm and one No. 6 copper service entrance conductor be satisfactory?

If three 250 mcm and one No. 6 copper service entrance conductors would be satisfactory where is this covered in the Code? What size fuse would be used for the power leg?—H.R.

The answer to your first question is that the three 250 mcm and one No. 6 service entrance conductors would be satisfactory. It would be unnecessary, and it would not be required to have the one phase wire used to service the motor load, only, to be of the same size as the lighting load conductors.

The code does not specifically cover this in so many words. This is more or less a matter of common sense and good engineering.

To illustrate this problem let us set up the actual conditions you have described by the following diagram:

It will be noted that line "A" has only the motor loads connected to

it. The two phases "B" and "C" have both the motor loads and the lighting load connected to them. The neutral supplies only the lighting load.

The minimum current carrying capacity of the feeder for the motor load would be based on 125% of the largest motor's full load current plus the full load current of all the other motors. In this case both motors are of the same size and type but cannot be started simultaneously. So for a 27-amp rated full load current we would obtain a size of conductor as follows:

1.25 x 27 plus 27 or 60.75 amps.

The minimum current carrying capacity of the feeder for the lighting load would be

45 x 1000 or 188 amps.

Phase "A" which has only the motor load connected to it would have to have a service conductor capacity of at least 60.75 amps. A No. 6 Type RH copper conductor (assuming the service entrance conductors would be installed in a conduit) would be sufficient since it has an allowable current carrying capacity of 65 amps.

Phases "B" and "C" have both the motor load and the lighting loads connected to them. Although not strictly correct, theoretically, for all practical purposes we may add both loads arithmetically as follows to determine the minimum service conductor capacities, viz.,

60.75 plus 188 or 248.75 amps. A 250 mcm, type RH copper conductor with a capacity of 255 amps would be sufficient.

It should be noted that the neutral conductor will carry under maximum conditions of unbalance only 188 amps. It may, therefore, be cut down in size. A No. 3/0 Type RH copper conductor having a capacity of 200 amps could be installed. From a practical standpoint, however, it would be found advisable to use the 250 mcm size for the neutral conductor also.

The fusing of the main service entrance conductors if a main service entrance switch were to be installed would be based on the following calculations:

For the motor load, the maximum feeder fuses would be 300% of the full load current of one motor plus the running full load current of the other motor, viz...

3 x 27 plus 27 or 108 amps.

For phase "A" a standard size 125-amp fuse would be sufficient. For phases "B" and "C" the lighting load would have to be added to this motor starting current, thus:

108 plus 188 or 296 amps.
This would be the maximum current in these two phases. Two standard size 300-amp fuses could be installed in these phases.

A 400-amp main switch would be required for the service switch. In phases "B" and "C" the 300-amp fuses would be installed in the fuse clips. In Phase "A" we would have to install a fuse reducer, viz., 400-to 200-amp reducer, and then we would install the 125-amp fuse in the clips of the 200-amp section of the reducer.—B.Z.S.—9/59/1

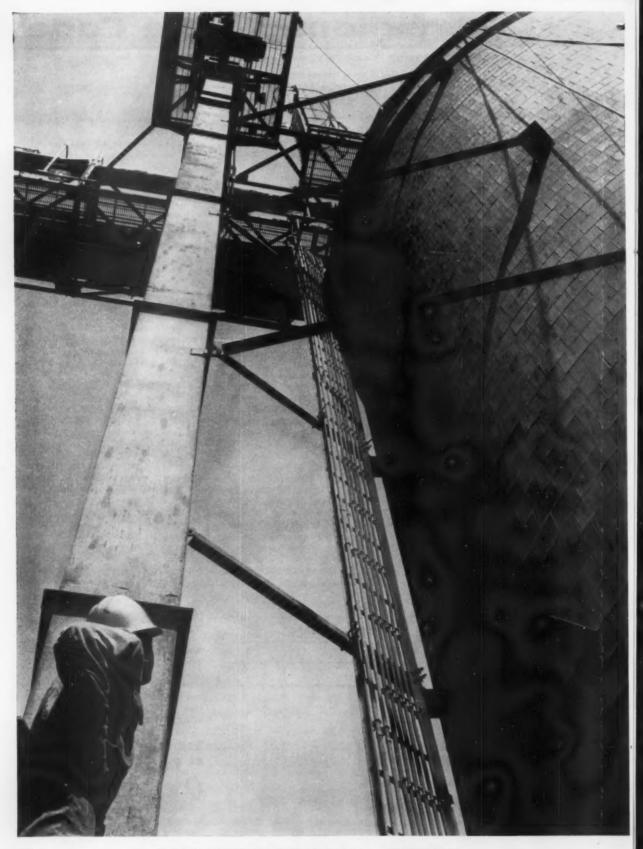
Editor's Note: The above calculations for size of motor feeder fuses are based on the 1956 NE Code. The 1959 code, in Example No. 8, sizes the motor feeder fuse as follows: $3\times27=81$ amps, next larger size = 90 amps. Feeder fuse = 90+27=117 amps. Use 125-amp fuse.—J.F.M.

Service drop and entrance conductors Feeder for lighting power 45 kw. 2-10 hp.240 v 3 ¢.S.C. motors

Seating Capacity of a Building

Q. Section 5211 states:
"WIRING METHOD. The
wiring method shall be metal raceways or Type MI cable except (1) as
provided in Article 640 and 800; (2)

across line starting



18

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . SEPTEMBER, 1959

Did you notice the General Electric Interlocked Armor Cable?

At first glance, you'd hardly notice the G-E interlocked armor cable in the picture, because it's so neat and compact, and because you don't expect cable to run vertically so far with so little apparent support. This versatility—plus a neat utilitarian look—are two big reasons why so many plants today are modernizing with G-E interlocked armor cable systems. Here are other equally important reasons that benefit both the contractor and his customer:

- 1. Installation cost is lower—often as much as 50% lower than with other conventional methods.
- Cables carry greater loads compared with other types of wiring.
- Less space is required—often as much as 50% less because fewer cables are needed.

How about installation? It's easy. Here's why:

- Long, continuous runs—even vertical runs, as shown in the illustration—are easy and practical. There are fewer splices, and no pull boxes are needed.
- Cable can be run around corners, over beams in congested areas, and through or on structural members.
- G-E VCI cable weighs ²/₃ less than conventional cable and conduit installations.

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For resistance to excessively corrosive atmospheres, the cable is available with a Flamenol* (polyvinyl chloride) jacket. These jackets can be supplied in vivid, lasting colors that also provide circuit identification. When corrosion is not a problem, colored aluminum interlocked armor can provide color coding.

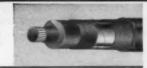
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Polyethylene

☐ Polyethylene control

Title

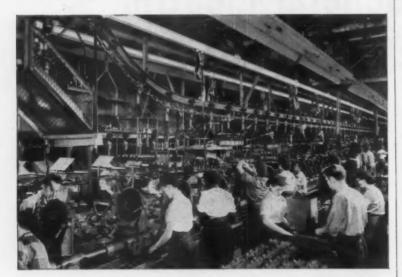
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Q. How may one determine the seating capacity of a building or part of a building?—

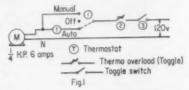
The 1959 National Electrical Code, Section 520-4 replaces Section 5211 of the 1956 Code. The 100 seating rule has been increased to 200 to correspond with requirements of the NFPA Building Exits Code. A fine print note has been added which states:

"For recommendations for determination of the population capacity refer to NFPA Building Exits Code (No. 101)."

This fine print note at least gives one desiring this information the publication from which such information may be obtained.—R.E.W.—9/59/2

Motor Controllers and Disconnects

As shown by Fig. No. 1, a hp. motor on a unit heater is controlled by an automatic thermostat. A 3-position manual-off-automatic switch is shown ahead of the thermostat. A thermal overload switch is shown as (2) and a toggle switch as (3). The branch circuit overcurrent device is out of sight of the controller.



1. Can the manual-off-automatic serve as the disconnect if switch (3) is omitted? Does this type of switch meet the requirements of Section 4402b? If it doesn't fulfil the requirements of this paragraph, how can it meet the requirements of paragraph 4402, namely "Every switch in the motor branch circuit within sight from the controller location shall comply with these requirements." Does it make any difference if the switch has toggle action or rotary action?

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2. Can the thermal-overload switch (2) serve as the disconnect (this is the toggle operated type) and thus eliminate switch (3)? Is there any limitations on the use of this type as a disconnect? Does the thermal-overload switch meet the requirements of paragraph 4402? Would it come under circuit breaker or switch?

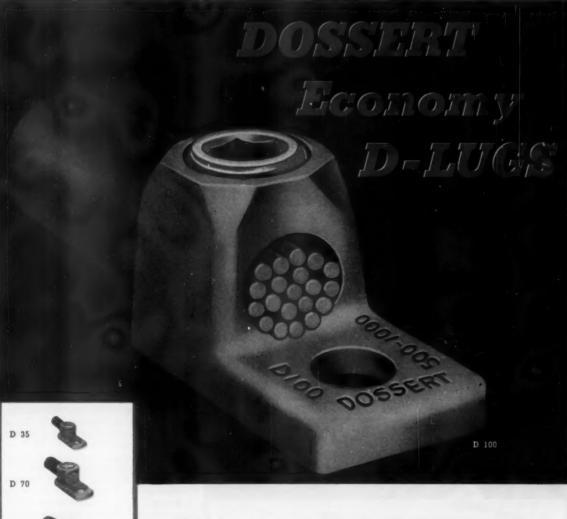
3. It seems that it would be quite awkward to require switch (3) as a disconnect. If switch (1) and (2) don't meet the requirements of paragraph 4402 as a disconnect then it doesn't seem that they could be used within sight of the controller (the thermostat) as discussed un-

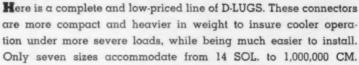
der (1)

4. If a controller is within sight of the motor as required by Section 4386 and the disconnect is within sight of the controller as stated in 4409, however the disconnect is not necessarily within sight of the motor, would it require a disconnect within sight of the motor if the controller and other switch cannot be locked open? Can find no requirement in the code that would require disconnect within sight of motor for this condition.—F.D.

According to the provisions of Section 4402b a stationary motor rated at 2 hp or less and 300 volts or less may have as a disconnecting means a general-use switch having a rating at least twice the full-load current rating of the motor. The provisions of Section 4407 recognizes an airbreak switch. operable directly by applying the hand to a lever or handle, or a circuit breaker operable directly by applying the hand to a lever or handle. Section 3811 recognizes the use of a circuit breaker as a switch. According to the provisions of Section 3814c, a snap switch controlling an inductive load (such as a motor) must have a rating twice the ampere rating of the load unless they are etc. (not pertinent).

It appears evident from the foregoing that a snap switch, rated at least 12 amps, would satisfy the disconnecting means for a 1 hp motor with a 6-amp rating. The same reasoning applies to the 3-position switch. It also may be used as the disconnecting means provided it is rated at 12 amps or more. It is significant to note however that the advice given by UL under their listing of snap switches, which reads as follows: "While most snap switches will operate on circuits having some appreciable inductance, it should not be assumed that they will be found wholly satisfactory (at their full ratings) on circuits in





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Motor Pump or MP-30 three phase 2 Hp. Motor Pump for faster bending. Write for detailed Catalog No. 35, or see your electrical wholesaler for full information. which there is a considerable inductive effect. Inasmuch as the factor of safety on these snap switches is not the same, it is not possible to assign any proportional rating or general rule for the use of such switches on inductive circuits." UL lists snap switches with hp ratings which are tested at rated voltage at six times motor full load running current at 40% to 50% power factor for ac horsepower ratings. It is quite possible that the 1959 Code will add a sentence to the provisions of Section 3814c reading:

"On ac circuits, general use ac snap switches may be used to control inductive loads, other than motors, not exceeding the ampere rating of the switch."

In reference to question No. 2. motor starting switches, suitable for the control and protection of fractional hp motors are available, and approved by UL. Such switches incorporate positive overload protection by the use of suitable thermal heaters. In my opinion such switches satisfy the provisions of Section 4402 since they are rated in hp. One of the "old timers" manufactored by Westinghouse is called the "Sentinel Breaker." Others. such as G. E. designated as motorstarting switches. Regardless of designation either one satisfies the provisions of Section 4402 for a motor disconnecting means within their rating.

In answer to question No. 3, every switch within sight from the controller location shall satisfy the provisions for a motor disconnecting means. As a result the 3-position switch, which is essential to satisfy the method of operation desired must be rated at least 12 amps. The starting switch with positive overload protection, which also is desired, is rated in hp and may serve as both the disconnecting means and manual controller for the motor. As a result the switch marked (3) on your diagram is not required.

I believe your fourth question is general in nature, and does not particularly refer to the circuit shown by your diagram. The provisions of Section 4386 require a motor to be within sight of the controller location with exceptions for other methods of procedure. This provision, as you say, is satisfied. The provisions of Section 4409 requires the motor disconnect to be within sight from the controller location (not the motor location) or be arranged to be locked in the open position. This rule does not say that the motor disconnect must be located within sight of the motor

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location. Under the conditions outlined in your question, it appears that both code rules are satisfied, and an additional switch is not required. Many designers, however, find that the installation of an additional switch at the motor is justified regardless of minimum code requirements.—B.A.McD.—9/59/3

Branch Circuit Overcurrent Devices

In a coin operated, unattended, self-service laundry. the main service switch of 200-amp capacity fused at 200 amps is located in a storage room that is kept locked and is not accessible to persons using the laundry equipment. A No. 2 feeder is run 20 ft to a 100-amp breaker panel located in the laundry room in a cabinet housing a double drainboard kitchen sink. This panel is located behind the piping running from the floor to the sink connections. Branch circuits are run from this panel to the coin operated washing machines. Another No. 2 feeder is run from the main switch a distance of 22 ft to another 100-amp breaker panel in the storage room. Neither of the breaker panels has a main. All breakers in the panels are 20amp size. From the panel in the storage room branch circuits are run to the coin operated driers located in the laundry room.

Does this installation meet National Electrical Code requirements?—F.O.C.

A. No. Section 2373 states:

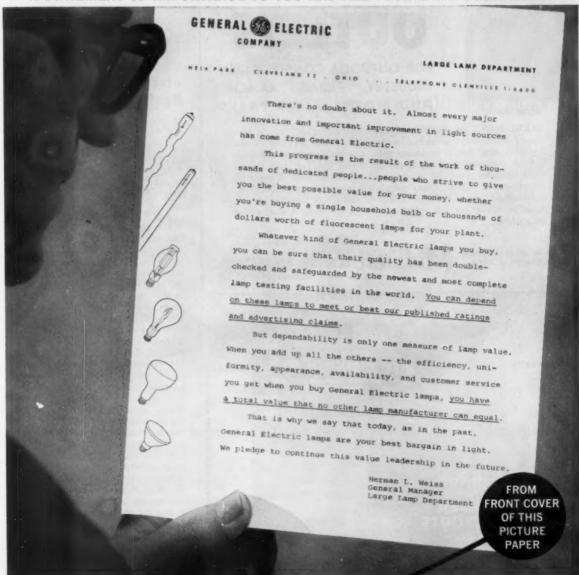
A. "LOCATION OF BRANCH-CIRCUIT OVER-CURRENT DEVICES. If the service overcurrent devices are locked or sealed, or otherwise not readily accessible, branch-circuit overcurrent devices shall be installed on the load side, shall be mounted in an accessible location and shall be of lower rating than the service overcurrent device."

Neither of the branch-circuit overcurrent devices can be classed as accessible to people using the laundry equipment although one is located in the room where the laundry equipment is installed as it is in a cabinet behind piping. Section 4411 of the 1956 Code also applies.

Section 2434 (d) states:
"TAPS NOT OVER 25 FT
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have a current-carrying capacity at
least one-third that of the conductor from which they are supplied,

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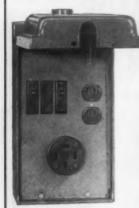
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and provided the tap is suitably protected from mechanical injury, is not over 25 ft long, and terminates in a single circuit breaker or set of fuses which will limit the load on the tap to that allowed by Tables 1 and 2, Chapter 10. Beyond this point the conductors may supply any number of circuit breakers or sets of fuses."

Neither feeder terminates in a single circuit breaker or set of fuses. Therefore, the load is not limited on the tap.—R.E.W.—9/59/4

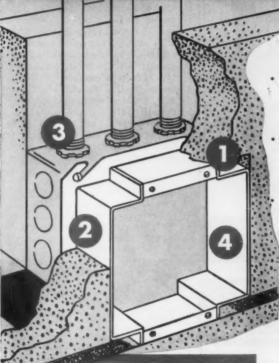
Electrical Space Heating

Q. Section 4279-a states that in exterior walls, wiring shall be located outside the thermal insulation. When the sidewalls are blown, which is often the case, this is an impossibility. Please comment.—C.R.A.

For the benefit of our read-A ers, Section 4279-a concerns the wiring in exterior walls incident to the installation of fixed electrical space heating equipment. As covered by your question, wiring in exterior walls shall be located outside the thermal insulation. As an example, the interior surface of the wall consists of plaster, in which is embedded heating cables. The voids in the wall are filled with thermal insulation which protects the wiring from abnormal temperatures, when such wiring is located outside the insulation and adjacent to the exterior surface of the wall. Under such conditions the conductor current-carrying capacity is not de-rated due to the ambient temperature created by the heated wall. The rule however is mandatory, and no consideration is given to the possibility of wires located within thermal insulation as provided for ceilings under Section 4278-a.

One of the prime requisites for an economic installation of electrical space heating concerns the thermal insulation in walls and ceilings. Ordinarily such insulation would be installed before the electrical wiring and there would be no problem. Insulation, blown into the voids of outside walls usually occurs on an old structure where it is impractical to otherwise insulate the walls. If such a structure is to be electrically heated through wall panels or heating cables, embedded in plaster, it appears that the provisions of Section 4279-a could be satisfied when such panels or walls are installed.—B.A.McD.—9/59/5

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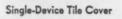
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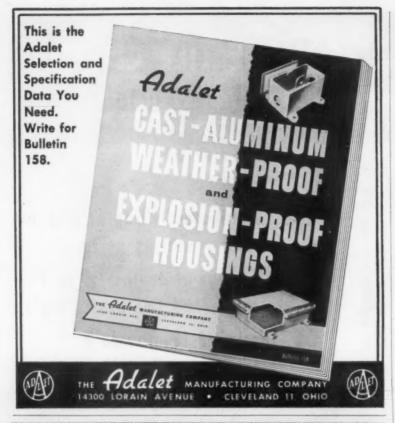
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Underground Feeder Cable

Q. Under what conditions may underground feeder cable be used as a feeder to a water pump from a pole-meter installation on farm property?—C.A.M.

Section 3392 states in part: A. "Use. Underground feeder and branch circuit cable may be used underground, including direct burial in the earth, as feeder or branch circuit cable when provided with overcurrent protection not in excess of the rated current carrying capacity of the individual conductors. If single conductor cables are installed, all cables of the feeder circuit, sub-feeder circuit or branch circuit, including the neutral conductor, if any, shall be run together in the same trench or raceway. If buried directly in the earth, supplementary mechanical protection, such as a covering board, concrete pad, raceway, etc. when considered necessary, may be required by the authority enforcing the code.'

From the above it will be noted that overcurrent protection is required on the pole where meter is located, such protection not in excess of the rated current carrying capacity of the conductor.—R.E.W.

-9/59/6

Fire Wall

Q. Article 100 Definitions. In the definition of a building the term fire walls are used. What height above a combustible roof must these fire walls extend?—C.T.

As discussed from time to time in this column, this is but another example where the electrical inspector has to refer to other standards for a complete understanding of his problems.

The question of a fire wall is not covered by just a simple requirement of a definition. First of all there are certain definite requirements as to where fire walls must be installed. The construction of these fire walls will vary depending upon the specific construction conditions involved.

The question of parapets—the extension of the fire walls above the building roof, etc.,—is also somewhat of a variable depending upon the type of fire wall and its relation to the overall building site. In general this extension may be either 2 or 3 ft above the roof.

Actually, these requirements are beyond the scope of the usual ac-

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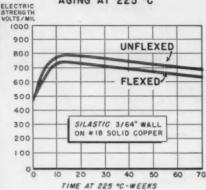


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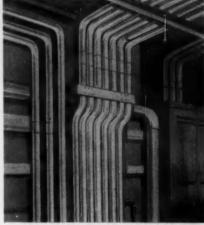
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Insulation Resistance

Q. How can Section 1120, paragraph 1 of the code be complied with on a branch circuit installation of fluorescent fixtures with rapid start ballasts, when each ballast tests approximately one megohm to ground? For example, a 20-amp circuit containing twelve 2/40-watt ballasts at one megohm each reads approximately 80,000 ohms to ground.—F.S.

The provisions of Section 1120 covering insulation resistance are not mandatory, and the values covered by the table are only suggested as a guide where the insulation is subject to test. As a result, there is no definite mandatory code requirements covering this subject. The fact that the rule covers the question as a suggestion, indicates that the insulation resistance values should be satisfied when tests are conducted. There is a proposal now under consideration that would revise paragraph 3 of Section 1120 to read as follows:

"3—If lampholders, receptacles, fixtures or appliances are also connected, the minimum resistance permitted for branch circuits supplying same shall be not less than 50,000 ohms."

The status of this proposal is questionable at this time, and should not be recognized as a code suggestion. There is an indication however that some revision will appear in the 1959 Code. Questions similar to yours have come to the attention of the writer during the past few years, and the question is discussed in the July 1957 issue of the News Bulletin of the International Association of Electrical Inspectors. To be brief, the present suggested rules for insulation resistance, as outlined in Section 1120





cannot be satisfied when fluorescent fixtures, and some of our appliances are connected to the circuit. As one Inspector states "If the fixtures are wired with AF fixture wire you might as well forget the tests, just wait and see if the fuses or breakers will hold."—B.A.McD.—9/59/8

Heating Equipment

Q. Does the National Electrical Code prohibit the use of 480Y/277-volt heating equipment?

A. No. Section 2113 states in

"In dwelling occupancies, the voltage between conductors supplying lampholders of the screw-shell type, receptacles, or appliances, shall not exceed 150 volts, except that the voltage between conductors supplying only, (a) permanently connected appliances, or (b) portable appliances of more than 1,380 watts, or (c) portable motor-operated appliances of ½ horsepower or greater rating may exceed 150 volts."

It will be noted that this excepts permanently connected appliances or portable appliances of more than 1,380 watts from the 150-volt requirement.—R.E.W.—9/59/9

Hospital Anesthetizing Locations

Q. Refer to NFPA bulletin No. 56, July 1956, Section 5, Electrical Wiring and Equipment. "5-1. General (b). An ungrounded

electrical system, explosion-proof in hazardous locations, is specified in this section. Such a system, etc."

"5-5. Arrangement of Circuits.
(a) in anesthetizing locations an ungrounded electrical distribution system is required to reduce the hazards of electric shocks and arcs in the event of insulation failure. Alternating current circuits shall be insulated from the conventionally grounded alternating current supply by means of one or more transformers which isolate the circuits electrically from the main feeder and from the other circuits in the building, etc."

"5-3. Anesthetizing location. Note. Replacement units, which are in themselves explosion-proof, may be used for receptacles and switches in lieu of a complete explosionproof wiring system for existing anesthetizing locations if acceptable to the inspection authority having jurisdiction. In new installations complete explosion-proof wiring systems are required as partitions are open during construction, and such systems are practical to install."

In existing hospital anesthetizing locations does the NOTE under Section 5-3 mean that "an ungrounded electrical distribution system would not be mandatory provided the system is explosion-proof in all other respects?" That is, all receptacle outlets and switches are explosionproof. To make the electrical system ungrounded, in the particular hospital which I have in mind would require rearranging circuits and installing junction and switch boxes in existing walls. To install such an ungrounded system would also require considerable channelling in existing walls. Incidentally there are four such locations in the hospital in question and the electrical system serving this hospital is 208/120 volts, 4-wire, 3-phase, wye. This means that the circuits involved are 3-phase, which would require an isolating transformer for each phase, as well as for each of the individual anesthetizing loca-

The insurance underwriters state that the ungrounded system is required more on account of shock hazard to personnel rather than protection against explosion.—W.G.

In my opinion the note only · refers to the equipment and fitting only, and does not apply to the wiring system. The purpose of the wiring system is specifically stated in the Section 5-5 you quote in the above. The isolating transformers isolate the systems to prevent both shocks and arcing. The arcing may result from static conditions also. The arcing, no matter how caused, can present definite hazard. In the case of static arcing there are quite a few recorded deaths resulting from this static arcing igniting anesthetizing gases within the patients' bodies.

Ungrounded systems must be kept broken up into relatively small systems to make them effective.

For example, suppose that you install the isolating transformers at only one location and extend isolated feeder systems to the various distribution cabinets throughout the various anesthetizing areas. At 120 volts a 2 ma leakage current will appear when the total insulation resistance will fall below—

120/.002 or 60,000 ohms. Suppose that each branch circuit shows an average of 5 megohms inNEW upward revisions in RLM Specifications make it more important than ever to

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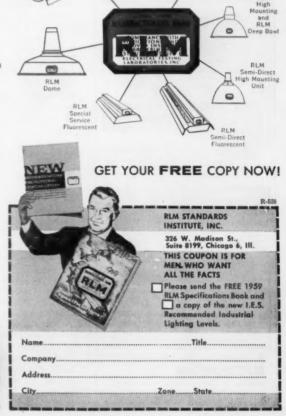
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126 or 40,000 ohms, approximately.

Thus, because of this broad exposure of branch circuit wiring, we may have a leakage current available in excess of the 2 ma maximum. This may cause the detectors to continuously show a "ground" even though the system is clear and quite intact.

It is advisable to always keep the "ungrounded" system broken up into small areas with an individual isolating transformer serving each area. It may be more costly but in the overall analysis it will be the least expensive installation when evaluated in the possible number of lives that may be saved.—B.Z.S.—9/59/10

EMT in Concrete Floor Slabs

Q. In this locality there has been some question about the use of EMT under floor slabs that are in direct contact with earth and fill. Section 3482, Item 2 states that EMT shall not be used in cinder concrete or fill where subject to permanent moisture etc. Section 3488 states that if EMT is used in fill or in wet places it shall be made watertight. Will you please clarify whether or not EMT may be installed under a floor slab in fill and, if so, under what conditions?—A.R.B.

A tem 2 of Section 3482 intimates that EMT may be buried in the ground or embedded in concrete provided it is not installed in cinder concrete or cinder fill where subject to permanent moisture. When so installed it must be protected on all sides by a layer of non-cinder concrete at least 2 ins. thick. It also may be installed 18 ins. under the cinder fill.

Official Interpretation No. 444 issued in January 1958, tends to clarify the question. It reads as follows:

"Question—If ½ in. or ½ in. electrical metallic tubing is installed in the center of a 4-in. slab of noncinder concrete in direct contact with the earth, with sand and gravel fill, would this be prohibited by Item 2 in Section 3482 of the 1956 Code?

"Answer-No."

Another official interpretation issued April 18, 1949 also may tend to clarify the question. It reads as follows:

"Question—With reference to Section 3482 of the 1947 edition of the National Electrical Code, would the placing of electrical metallic tubing under a wire mesh reinforcing prior to the pouring of a concrete floor slab be a prohibited installation?

"Answer—No, provided the installers and inspection authorities are assured the tubing will not be damaged through construction operations."

Section 3488 of the code requires threadless couplings and connectors used with tubing to be made up tight, and if to be buried in masonry, concrete or fill, or if installed in wet places to be of a type to prevent water from entering the raceway. The code does not say that such fittings shall be made watertight. Underwriters' Laboratories list some couplings and connectors as raintight and concretetight. Such fittings are considered suitable for use when EMT is buried in concrete, installed underground, or exposed to the elements. Some fittings are only listed as concrete tight.-B.A.McD.-9/59/11

Conductors in Conduit

Q. Can a No. 4 uninsulated solid copper conductor be used as the neutral conductor in a conduit service?—M.F.K.

No. Section 3104 states:

"STRANDED CONDUCTORS. Except when used as bus bars or in Type MI Cable, conductors No. 6 and larger, installed in raceways, shall be stranded."

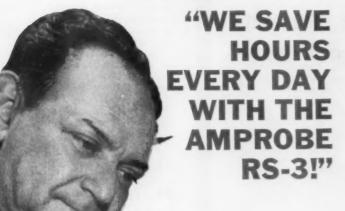
There is some confusion regarding this section and in order to clarify it, it is necessary for one to read the fine print note under 3101 which is:

"The provisions of this article are not intended to apply to conductors which form an integral part of equipment such as motors, motor controllers, and the like, or which are provided for elsewhere in this code."

The last part of this fine print note can mean exceptions to the rule of Section 3104 such as a part of section 2591 a, which refers to the grounding conductor:

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GROUNDING CONDUCTOR. The grounding conductor of a wiring system shall be of copper or other corrosion-resistant material. The conductor may be solid or stranded, insulated or bare."

My interpretation of the rule is on a grounded system a combination neutral and grounding conductor may be used in a service and, if No. 6 or larger, shall be stranded. If separate conductors are used for the neutral and grounding conductor, the neutral, if No. 6 or larger, shall be stranded and the grounding conductor may be solid.—R.E.W.—9/59/12

Dispensing Island Lamp Standard

Q. On an island of a filling station what is the proper entrance of conduit into a lamp standard?—H.R.

A. This will all depend on the lamp standard itself. The lamp standard being on an island gets itself involved in being installed in both a hazardous area (Class I, Division I area up to 4 ft above ground level) and a non-hazardous area (above the 4-ft level).

Some inspectors have required two seals. The first seal at the point where the conduit comes from the underground area into the light standard on the island (see 5120f—proposed 1959 Code Section 514-6a). The second seal is required at the point where the light standard conduit passes from the Class I, Division 1 area to the non-hazardous area at the 4-ft level.

Other inspectors have accepted just one seal at the 4-ft level.

The problem becomes quite involved when applied as a practical solution for a specific problem. In many cases the light standard is so constructed that it is impossible to install the conduit within the standard itself. This requires that a separate conduit be installed on the outside of the standard. Seemingly a strict interpretation of the code would require two seals. However, it would certainly seem logical that as long as the conductors are pulled in as one continuous conductor without splice or tap between the distribution cabinet and the lampholder in the standard, that one seal should be sufficient. Locating this seal at the point where the conduit emerges from the underground into the island should offer the maximum protection required. — B.Z.S. -



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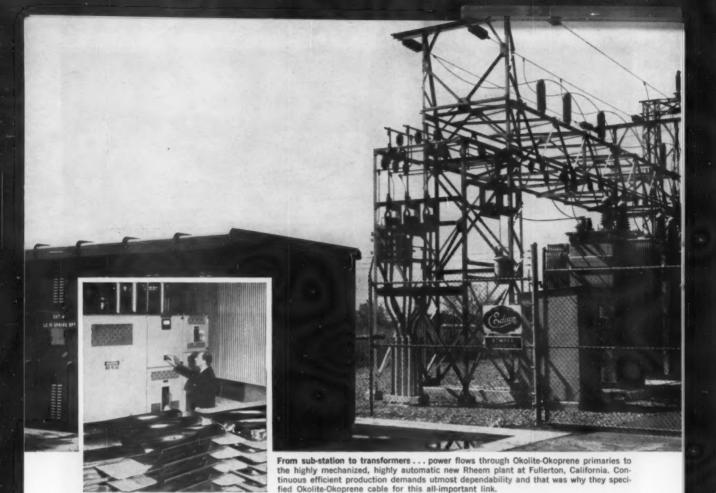
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"The Fullerton plant is one of Rheem's newest and smartest and had to have nothing but the latest and best equipment. We knew that meant Okolite-Okoprene cable and we used it. It has worked perfectly since installation, has required no maintenance, and we would recommend it to anyone."

Selected as one of the ten best new plants in the country last year, this highly efficient plant uses the most modern power distribution techniques to keep its plant presses and plating baths operating. Production will pass one million auto bumpers, one million auto springs and three million bumper arms per year.

All power for this must-not-fail operation flows through Okolite-Okoprene 12,000-volt primary distribution lines, designed to supply a future 100% increase in plant capacity. They connect outdoor sub-station switchgear to 13 indoor step-down transformer centers which distribute to plant operations at 480 volts.

For your vital circuits, Okolite-Okoprene offers constructions of utmost reliability combined with exceptionally long life. Okolite insulation has a 30-year record of service, maintaining in severest installation conditions its high dielectric strength and great resistance to corona cutting, moisture and heat. Okoprene sheathing offers unusual protection against weather, abrasion, ozone, heat, cold, many acids, alkalies, and chemicals. Application of the insulation by the strip process is the ultimate assurance of matchless quality. For the Okolite-Okoprene cable that best suits your needs, see 128page Bulletin EC-1075. It's free; just write The Okonite Company, Passaic, New Jersey.



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In the News

IAEL Reviews Industry Programs

Unprecedented promotional programs for electrical industry market objectives were highlighted at the 24th annual conference of the International Association of Electrical Leagues in San Diego, Calif.,

August 11-14.

Where There's a Strong Association. There's a Strong Industry." theme of the conference, was stressed by John S. McDermott of Kansas City, retiring president of the IAEL and keynote speaker, who pointed out that the electrical industry has been blessed by the support of not one but many strong associations. Citing many contributions made by these organizations, McDermott stated that electrical leagues constitute logical rallying points for all electrical promotion and activity, inasmuch as leagues have no axe to grind except interests of the industry as a whole.

In forecasting the Economic Outlook, Sterling Brubaker, associate economist for the Bank of America in San Francisco, predicted that although the country is not headed for a wild buying binge, a continuing solid market should be assured by such basic factors as our growing population, the need for more homes and schools, appliances and cars, highways and water systems, plus a broadening stream of related goods and services. 1960 should mark the beginning of a decade which will be served electrically to an extent never before dreamed possible, he maintained, citing numerous examples to emphasize industry's plans for new plants and equipment, investments in research and development, rising sales and replenishing of depleted inventories. These signs all point to a sustained economic impetus, he summarized, adding that next year should witness an overall economic boost of at least 5%; a GNP above the halftrillion mark, and a good living for all

New Benefits

The declaration that "National Electrical Week is Here to Stay" was voiced by Herbert E. Cook, executive secretary of the Electrical Association of Detroit, who stated that his claim was predicated on broad sponsorship. Last year over

350 separate electric groups representing all of the United States, eight Canadian Provinces and other countries on four continents backed this all-out tribute to the electrical industry, he continued, adding that the NEW committee cooperated with all of these groups by supplying planning guides, emblem illustrations, promotion pamphlets, mailing pieces, pattern speeches, displays, buttons, booklets, exhibits, film clips for local TV programs, and fact sheets.

How national manufacturers can cooperate in the NEW program was reviewed by Charles G. Arps, public relations representative for Allis-Chalmers in Milwaukee, who exhibited slides, news releases, advertisements and recorded radio programs that had been used by his own com-

pany in former years.

To indicate how Eye-Fi relighting programs can stimulate public acceptance of higher lighting standards, W. M. Freudigman of Providence, member of the National Lighting Bureau's executive committee, cited statistics and results related to a recent Certified Lighting contest conducted in Rhode Island. In that contest, 555 out of 723 entries had been originated by electrical contractors and, of this number 493 had been certified for value. Freudigman maintained that a certified lighting installation boosts salability of homes, commercial buildings, and industrial plants by focussing attention of buyers



NALMCO's new officers for 1959 receive the good wishes (and gavel) from outgoing President Glen Shatola (right) at the recent annual conference of the National Association of Lighting Maintenance Contractors, held in Denver, Colo. The new President is Melvin Galbraith (second from right), Approved Lighting Service, Cedar Rapids, Iowa. Secretary Is Malger Gray (second from left), Fluorescent Service, Inc., Tampa, Fla., and Treasurer is Ken Purington (left), Lighting Sales & Service, Davenport, Iowa.

upon prestige features, and that lighting contests can be linked with training programs and local advertising campaigns to benefit the contractor and the public alike by boosting quality of design and installational workmanship.

Generating Potential

In reviewing "Trends in Growth of Electric Loads," James T. Coatsworth, commercial director for EEI. New York City, brought out the fact that during the past decade the average home owner's kwh consumption has more thn doubled, jumping from 1563 to 3366, while ratios between kwh and manhours have also zoomed in industry and on the farm. To keep pace with this growth, the generating capacity of the country has been increased to 144-billion kw. This includes a current reserve capacity of 271% at present, but this generating capacity is being raised each year by about 10% in order to maintain that margin. Sales of both major and minor appliances is again on the uptrend, he stated. adding that in March of this year, for the first time in history, production of electric ranges exceeded the total of ranges using gas as the heating medium. Sales of electric space heaters, air conditioners, dehumidifiers, clothes washers and dryers were also up, he said, indicating a high order of home owner acceptance which could be boosted still higher by coordinated promotion by the industry.

EEI Promotion

In discussing promotion programs related to EEI's Electric Living campaign, Don Willis, vice president, Arizona Public Service Co., Phoenix, urged League managers to coordinate local sales efforts with the wealth of national publicity that is urging the public to cook better, heat better, cool better, wash better, dry better, give better and Live Better, Electrically, adding that this one main theme will dominate EEI's 1960 promotional investments in all up-coming magazine and TV plans. Believing that daytime TV is a promotional "natural" by combining sight, sound and motion, Willis stated that 64 such programs are being scheduled for the coming year for the purpose of showing housewives how



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FLYING MOTOR SHOP OPERATORS meet in Kansas. At left, Bill Horton, manager, Mid-States Armature Works, Salina, Kans., greets his father, Ben, and brother, Frank, at Salina airport on their arrival in their company plane. Ben Horton, a NISA director, and Frank are associated with The Atkinson Armature Works, Pittsburg, Kans. All three men are licensed pilots, use their aircraft on company business.

to properly operate their major appliances, how to cook and to wash, how to use light as a decorative medium as well as for functional illumination, and how to check for adequate wiring and control in their homes.

Dynamic advances in the field of electronics was the subject of a talk by Robert S. Bell, president of Packard-Bell, Los Angeles, who cited developments and uses of transistors, electronic controls for productive processes, closed-circuit TV for monitoring dangerous operations, ultrasonic therapy and surgery, 3D TV, electroluminescence, high-frequency cooking and transmission of tape-recorded messages from satellites in orbit. Mentioning that 29% of our entire national defense budget is being invested in electronic devices, he concluded that the coming decade would see new strides toward health, comfort, convenience, control and protection as a result of contributions now being made by this growing industry.

Considering "What's Ahead for the Appliance Industry," George T. Bogard, from General Electric's Appliance Park in Louisville, Ky., gave a slide presentation to show how his company is promoting "packaged" home-building with structural components, extruded-aluminum cages, plastic panels, built-in kitchens and new home appliances that may be added to this experimental home as function or desires dictate.

Lester E. Barrett, chairman of the National Wiring Bureau and president of the Barrett Electrical Supply Co., St. Louis, stated that products plus intelligent promotion results in profits. In so doing, he pointed out that NWB promotion is educating the public to call upon qualified contractors for wiring and controls, and that contractors, once this initial contact is established, should then grasp the opportunity to educate home owners to the advantages of such extra (high profit) items as appliance centers, special-purpose control panels and outlets, low-voltage remote controls, electric heat and photocell controlled lighting. In recommending this "up-sell" approach, he stated that it can apply to expansion and modernization projects as well as to new construction, and he added that it would be mutually beneficial if all manufacturers in the housepower-product field would set up series of related exhibits, then conduct tours for local contractors so that these key men in the installation picture would know what is available, how devices operate and the full extent of their advantages.

On the related subject of Adequate Wiring, Alan Waxenburg, coordinator for Look magazine's A-W Competition announced that next year's contest will be the paper's sixth; that a new classification has been established to include installations promoted by Electric Leagues and Wiring Bureaus, and that it will be his magazine's objective to focus public attention upon the false economy of accepting "inexpensive" wiring systems which are potentially hazardous and limit the extent to which modern home owners can enjoy benefits related to full-scope Electrical Living.

Speaking about electric heating, Herbert B. Blumberg, president of for high voltage service continuity on your critical load at lower capital ou it's S&C Metalclad Switchgear!

To get service continuity on critical loads, you need preferred-toemergency switching of your alternate incoming high-voltage supply circuits, and short-circuit protection and switching on your outgoing high-voltage supply feeders. All of this can be provided in one lowcost package in S&C Metalclad Switchgear, as illustrated.

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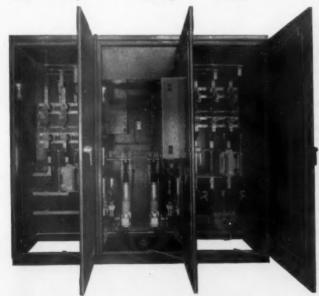
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No organic insulation to cause corona trouble; porcelain and air only.

High-Speed Automatic Switching.

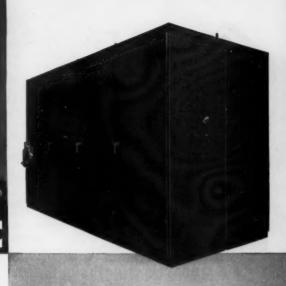
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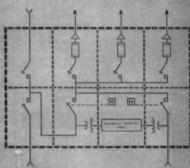


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the Detroit Electrical Association and vice president of Cadillac Electric Supply, maintained that public recognition of this heating medium already has been secured, but that there is a strong possibility that this field can be lost by contractors to the heating industry if electrical organizations do not adopt a more vigorous promotion attitude. He added that the best way to entrench ourselves in this field is to prove that the electrical construction industry is the most effective and efficient channel for promoting, installing and servicing electrical heating systems, and that industrywide effort is required to do a competent job of selling.

Work Sessions

In a series of practical working sessions wherein formal discussions were augmented by numerous questions and comments from the floor. Ralph B. Hubbard, Rocky Mountain Electric League, Denver, Colo., and John A. Morrison, Electrical Assn. of Philadelphia, presented a host of useful suggestions pertaining to the organization and conductance of industry conferences and activities, while Al Kessler, executive secretary for the North Central Electrical League of Minneapolis, analyzed essential components of constructive leadership.

On the final day of this 4-day meeting, D. J. McGonigle, Montana Power Co., Butte, urged greater industry unification through the adoption of an Electro-Day promotion campaign, such as one now being practiced successfully in his state. On this one day each month, the electrical industry should stress quality and advantages of products rather than price, he maintained, adding that this program would augment the Electric Week concept and could be backed up by all-out newspaper, radio and TV promotion which could relate local to national selling efforts. To be effective, however, such drives should be on a sustained scheduled basis, and they should combine imagination and vision with know-how and cooperation, he summarized.

NECA's Market Analysis was the subject of a talk by Paul M. Geary, executive vice president of that Association, who stated that electrical contracting is a branch of the construction industry (the nation's second largest economic category) and that although individual contractors perform services at many local jobsites, their combined activities are influenced by and contrib-



KARL STOLTING, Santa Rosa, Calif., electrical contractor, has a 200-fc lighting installation in his own office as a practical indication of his advocation of high quality-and-quantity illumination.

ute directly to national trends.

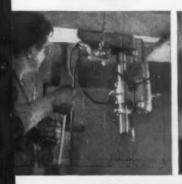
Looking into a "clouded crystal ball," Laurence Wray, editor of Electrical Merchandising, New York City, stated that the appliance industry was experiencing a promising rejuvenation following a 2-year recession, and that growth in the entire electrical industry during the next decade will be far greater than during the decade just past. Growth, however, will bring new problems, greater competition for business and a greater challenge to electrical leagues, he said. Therefore complacency cannot be tolerated. More local leagues must be established; existing leagues must grow in size and in importance, and league managers must think big in order to bring the industry's full petential into focus.

Carl T. Bremicker, chairman of the North Central Electric League in Minneapolis and vice president for the Northern States Paper Co., challenged the league managers to fight harder for the interests of their members. This is a competitive market, he claimed, and competition means struggle and trouble. Therefore, if you aren't in trouble, you're not doing a conscientious job. Managers, however, should think of themselves as captains of a ship and should put more pressure on the "crew" to hustle, cooperate with each other and with members of other communities and states in giant coordinated industry-wide ob-

Discussing developments in the field of power generation, Dr. Park



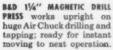
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Whether your job is production, construction or maintenance, a Black & Decker Magnetic Drill Press sticks like glue to the job. Lets you stand off and guide the bit from a distance. And it takes just finger-pressure to drill even a 11/4" hole with Black & Decker's exclusive Hydra-power Feed.

See one on your work. Two sizes to choose from: 3/4". and 11/4"; both complete precision units-not attachments. Perfect for drilling, reaming, tapping in tool shops, steel fabricating, maintenance-anywhere you need a drill press but can't take the work to the tool.



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- Send me additional information
- Send me information on the tools checked below.

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EIGHT BROTHERS head up Kassay Brothers, electrical contractors of Smithtown, N. Y., now in their seventh year of handling a full range of industrial, commercial and residential work. Above (I to r) are Paul (vice pres), Andy (sec-treas), John, George (pres), Jasper (vice-pres), and Jim Kassay. Missing from photograph are Alex and Steve.

H. Miller, Jr., director of the experimental physics group for the General Atomic Division of General Dynamics, San Diego, stated that thermo-electric high-temperature gas-cooled reactors have a real possibility to replace other conventional methods for mass production of electrical energy. Within a year, 100-kw units will be available with efficiences of about 15%, he said. And, although such units will be relatively small, costly and inefficient, they should have applications for use in remote areas or locations, since long life and lack of moving parts would be valuable attributes under those conditions.

Simpson Elected President

At the annual business session, Clifford C. Simpson, managing director of the Chicago Electric Assn., was unanimously elected as president of the IAEL. Elected to serve with him were William M. Freudigman, new Association vice president, Electric League of Rhode Island; Robert J. Harrison, treasurer, Nebraska-Iowa Electrical Council, and Robert O. Trottier, secretary, managing director of the Intermountain Electrical Association, Salt Lake City.

Elected concurrently to serve on the Board of Governors were John A. Morrison, Electrical Assn. of Philadelphia, for District One; Albert I. Maillard, Electric League of Indianapolis, for District Two; Ralph B. Hubbard, Rocky Mountain Electrical League, Denver, for District Three; Glen L. Logan, Electrical League of Los Angeles, for District Four; and Harry J. Foy, Electric Service League of Ontario, Toronto, Canada, for District Five.

At this same session, delegates also voted to hold their next three annual conferences in Kansas City, Atlantic City and Chicago; 1960 meeting to be October 5-7.

NISA News

More than 125 members of the National Industrial Service Association have agreed to serve on the organization's 21 committees, president Horace C. Blenkhorn has announced.

Heading three committees for 1959-60 will be George Edward Jones, of G. E. Jones Electric Co., Amarillo, Texas. He will be chairman of the audit, insurance and rebuilt equipment committees.

Other committee chairmen are: Carl Lundberg, Cascade Machinery and Electric Co., Seattle, Washington, budget and finance;

Selden F. High, The Sullivan Electric Co., Cincinnati, Ohio, bylaws and resolutions;

J. Arthur Turner Jr., Tampa Armature Works, Tampa, Florida, chapter affairs;

Thomas M. Paul, Paul Electric Co., Sioux City, Iowa, chapter territories and regional boundaries;

John G. Persson, Electric Apparatus & Repair Co., Philadelphia, educational and employee training;

Ross T. Sawle, Blenkhorn & Sawle, Ltd., St. Catharines, Ont., Canada, engineering;

Alex A. Shovan, Industrial Electric Service, Hawthorne, N. J., Ideas Contest;

Alfred Elson Jr., New England Machine & Electric Co., Pawtucket, R. I., industrial relations;

Arthur G. Bamford, Sutherland-Schultz Electric Co., Kitchener, Ont., Canada, management;

Ben J. Horton, Atkinson Armature Works, Pittsburg, Kansas, marketing;

Joseph F. Dudley, Dudley Electric Works, Flint, Mich., membership;

Joseph W. Cavataio, Illinois Electric Works, East St. Louis, Ill., public affairs:

Clarence S. Moran, Standard Electric Motor Works, Detroit, 4 labor saving reasons to specify-**Paranite** PARASYN® **TYPE TW** 600 V. BUILDING WIRE Dead soft" conducto provides flexibility for ast, labor saving installation. Smooth Slick silicone surface **Plainly Marked** finish-reduces friction Large legend type for for easy pulling. quick identification The GOO VOLT 500 MCM Other features of Paranite Parasyn Type TW 600 V. building wire include a thermoplastic insulation that provides high dielectric, mechanical strength, longer life and is flame, moisture, and oil resistant. U. L. listed in sizes AWG 14 through 2000 MCM. Standard colors available from stock in both solid and stranded, sizes AWG 14 through 1000 MCM.

Each Carton packaged to reduce handling and labor cost with "color-coded" labels plainly showing type, size and color of wire. Also, new reel cards for instant identification and inventory control.

PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Marion, Indiana

Sold only through recognized electrical distributors

MANUFACTURING PLANTS: Morion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Ancheim, Calif.

Sales Offices and Redistribution Warehouses in all Principal Cities



Latrobe Electrical **Products**



"TRU-LEVEL"

Fully Adjustable

Floor Box

This "Tru-Level" box is very easy to install-with its 31/4" opening, it enables the inside attachment of conduit without removing the box body cover.

It is a sheet steel, galvanized 4" octagon watertight box 21/2" deep, developed for concrete, tile or wooden floor with concrete base.

Quick and easy tru-leveling, with 1/2" adjusting ring and 21/2" long screw legs.

Listed under re-examination service of Underwriters Laboratories, Inc.

Write today for complete specifications.

Non-Adjustable Floor Box

Represents the last word in unique design, neat appearance, fewest number of parts, and least amount of labor to install.





Insulator Supports

Fasten porcelain or glass insulators to steel framework without punching holes. 4 sizes—1", 11/2", 2" and 21/2".

Latrobe Products

Non-Adjustable Floor Boxes
Adjustable Floor Boxes
Adjustable Floor Boxes
Gong Boxes-Cover Plates
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Pipe or Conduit Hangers
Insulator Supports
Cable Supports-Fish Wire
Staple and Cable Clips

Sales Representatives in all principal Cities.





THE PRESIDENT of NISA's King Coal Chapter, John Eggimann, Cape Armature Co., Cape Girardeau, Mo., is at left, conferring with the chapter's secretary George Byars, of Dowzer Electrical and Machinery Works, Mount Vernon, III.

Mich., publications and publicity;

Warren C. Mielke, Mielke Electric Works, Duluth, Minn., rebuilding motor standards;

Rex Woodward, Dowzer Electric Machinery Co., Mount Vernon, Ill., rebuilding transformer standards;

Edwin E. Kolhonen, Peabody Electric Motor Co., Peabody, Mass.,

Paul Sievert, Sievert Electric Co., Chicago, Ill., trade relations.

Southern Electric Co., of Charlotte, N. C., opened a new building on July 17 for its Spartanburg, S. C. branch. More than 1,000 attended the two-day open house.

. . . Another open house was held in New Orleans recently by Industrial Electric Co., Inc. Demonstrations of the shop's new Silco-flex winding process, a display of its panelboards, switchboards and other controls, and a speech by D. W. Hertel, of Allis-Chalmers, completed the pro-

At Spenger's Grotto in Berkeley, Calif., members of NISA's Northern California Chapter met after touring the University of California radiation laboratories, June 8. At the meeting, Al Kinnery, Marysville, Calif., reported on the NISA International Convention, held in Montreal last May.

Poor housekeeping is one of the major contributing factors to repair shop accidents, a safety official of Florida told members of NISA's Florida Section in Fort Lauderdale on August 8.

.

Poor lighting and "unsafe acts," particularly lifting, also cause many accidents, Albert McIntosh, state industrial safety chief, said.

Mr. McIntosh was one of six speakers at the meeting, held at Galt Ocean Mile Hotel. Others included Don Saigh, of Insulation & Wires, Inc., St. Paul, Minn., Wally Burke, W. W. Grainger, Inc., Miami, Fla.; C. Y. Strausz, C. Y. Strausz, Inc., Atlanta, Ga.; Charles Schoen, Electric Insulation Suppliers, Inc., Altanta, Ga.; and Horace Barks, of Horace Barks Publications, St. Louis, Mo., editor, NISA News.

J. Arthur Turner Jr., of Tampa Armature Works, Tampa, Fla., national vice-president of NISA, addressed the meeting briefly. William C. King, of King Electric Motor Service, Miami, Fla., presided. . . .

NISA president Horace C. Blenkhorn will be the chief speaker at the meeting of NISA Heart of America Chapter in Joplin, Mo., October 9-10. Others scheduled to address the four-state meeting include staff engineer Arthur C. Roe; executive vice-president Joseph M. Harrington; and Horace Barks, of Horace Barks Publications, St. Louis, Mo., editor, NISA News. .

. . Entering Army service for six months on August 15 was Jerry Cohen, J-C Electric Co., Detroit. Manager in his absence will be Arthur Brunner.

Movies from darkest Africa were on the program of the NISA Great



PAUL BURRITT, partner of Mericle Electric Co., Milwaukee, Wis., points out features of No. 4 RR secondary taps leading into meter from all-aluminum underground distribution system installed for Ben Chitlik (right), owner of the College Trailer Resort. Power distribution system includes an 800-amp aerial feeder to a central service building, 9000 ft of cable divided into four 3/0 aluminum underground feeders, and 5000 ft of No. 4 secondary tops to the various trailer locations. The system also contains 2-way connector sleeves installed with 12-ton compression tools, while nine T-taps were used to effect 90-degree angle 3/0 splices. Splice coverings consist of scotch cast neoprene units.



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THE DARK ... NO

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STEPS

TURNS THEM ALL

OFF FROM THE

KITCHEN.



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APRON BEFORE

GREETING THEM.

ARE ON YOUR

WAY. THEY'LL

APPRECIATE IT.

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For genuine Black & Decker repairs check Yellow Pages under "Tools-Electric" for address of nearby Black & Decker FACTORY SERVICE BRANCH

Free tool inspection when requested • Genuine B&D parts used • Factory-trained technicians handle all work • Standard B&D Guarantee at completion of recommended repairs • Fast service at reasonable cost.

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—same sound engineering and fine workmanship. Technical improvements and modern insulations save up to 15% in weight, provide smaller, more compact motors. Same outstanding performance! Brook Rerate, and Standard Frame Motors, 1 to 600 horsepower available from warehouse stocks in principal cities. Get the cost-cutting facts—send for Bulletin 860!

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O. J. CARLISLE, of Russell Electric & Machine Co., Tucson, Ariz., checks out a motor generator set that was brought into his shop for service. The shop is one of several that are servicing motors, generators and other electrical equipment in the growing Southwest industrial and agricultural areas.

Lakes meeting, held at Carson's Chop House, Detroit, August 17. Lewis Ball, Electric Motor Co., Pontiac, Mich., made the presentation with films taken on his recent trip.

Theme of the Southwestern Chapter of NISA meeting in Houston, Texas, on September 17-19 is "The Motor Shop's Expanding Role and Responsibility to Industry."

Speaker at the October 16-17 meeting of Utah Chapter will be NISA president Horace C. Blenkhorn. The meeting will be held in Salt Lake City.

A meeting of Western Michigan Chapter was held in Ludington, Mich., July 20 at the Ferguson Electric Co. shop. The group also toured Jackson Vibrator Co., manufacturers of tampers and vibrators for railroad and construction use.



MASON V. GREEN (left), of Barker-Fowler Electric Co., Lansing, Mich., is congratulated on assuming the presidency of NISA's Great Lakes Chapter by his predecessor, William Saunders, Lenawee Electric Co., Adrian, Mich. At right is chapter secretary Charles Smith of J. E. Berger Corporation Division of Gordon Electric Motor Co., Detroit, Mich.

School Safety Program Costs Set at \$8 Million

The Chicago board of education has learned that the cost of removing all fire hazards from the city's 429 public schools will total over \$8 million. According to a study prepared by Edwin A. Lederer, associate superintendent in charge of education, the expenditure is necessary in order to bring the city's school system into compliance with the Chicago building code.

The biggest single cost is more than \$4 million for electrical installations, rehabilitations of exit sign and lighting systems, and for rewiring fire alarm systems and heat-

ing units.

The report also calls for installation of sprinkler systems in 20 of the city's schools built in the 19th century. The schools have been surveyed by the Chicago fire prevention bureau and the Board of Underwriters. The scentiny followed the Our Lady of the Angels Catholic school fire, which took 93 lives.

Complete sprinkler coverage is required by the Chicago building code for structures with wood interiors, the board of education has been told. But, Lederer pointed out that school administrators do not agree with city fire inspectors that installation of sprinklers is more important than removing other fire hazards. "We believe the need for sprinklers is secondary to other fire hazards," Lederer said, "But we'll have to comply with the city code first."

Included in the contracts totaling \$991,082 that have been awarded for elimination of fire hazards so far this year is the installation of electric exit signs in 29 schools.

New Books & Pamphlets

Code for Protection Against Lightning, NFPA No. 78, 48 pages, 50¢. National Fire Protection Assn., 60 Batterymarch St., Boston 10, Mass.

1959 revision of nationally accepted guide to proper installation of lightning rods and other lightning protection. Compliance with this code largely eliminates deaths and property damage from lightning.

Theory and Design of Small Induction Motors, by Cyril Veinott. 492 pages, \$13.50. Mc-Graw-Hill Book Co., 327 W. 41st St., New York 36, N. Y.

A comprehensive coverage of the



EVERY ELECTRICIAN SHOULD HAVE ONE - "Hi" TAPE-MATE modernizes all your present reels . . . protects your hands and eliminates kinks and broken tape.

TAPE-MATE comes in 2 sizes . . . fits all Holub and other 81/2" and 12" dia. round fish tape reels containing 1/8" flat fish tape. AND IT COSTS SO LITTLE . . . ONLY \$2.90!

Here's the complete unit.



TAPE-MATE comes in two sections. Place sections over reel, insert 4 screws and tighten. That's all you do! TAPE-MATE can't come off . . . no moving parts to repair or replace.

"Hi" FISH TAPE REELS have offset seam, no sharp edges, hold tape se-curely, contain the highest quality fish tape made! Five sizes fit TAPE-MATES.

NEW! Deluxe chrome plated "Hi" FISH TAPE REEL with TAPE-MATE attached -3 sizes!

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	Wrench	Screw	Anchors	and

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HOLUB INDUSTRIES, Inc.

442 ELM STREET . SYCAMORE, ILLINOIS

Research creates new, dualpurpose splicing tape

Underwriters' Laboratories have listed a new self-fusing tape for use as "the sole insulation and covering of joints and splices in electrical conductors." It is the only tape of its kind with U.L. approval.

2 Tapes in 1

The new tape — Okoweld — was developed by Okonite. It is designed to be used as both insulation and sheath on rubber and plastic cables operating under 2000 volts.

Guaranteed against oozing or drying out

Being a self-fusing tape, it has no adhesive coating to dry out, ooze, or cause slippage of the tape wrappings. Okoweld fuses into a solid, layerless, non-porous wall that won't crack or deteriorate in weather. It resists acids, oils and most chemicals.

Applies quickly and easily

This new tape has excellent plasticity that allows it to conform well to irregular surfaces. In addition, it has optimum tensile strength for easy wrapping on a splice or termination.

Ask for Okoweld the next time you order from your distributor.

Okoweld is manufactured by The Okonite Company, maker of superior electrical cables and the splicing tapes to go with them.

THE OKONITE COMPANY

Subsidiary of Kennecott Copper Corporation
Passaic, New Jersey

engineering, application, and design procedures that must be taken into account when working with small induction motors. Organized in four separate parts, the book describes engineering principles and characteristics, treats theory and performance calculations, provides methods and formulas for analyzing a given design, and shows how to design a machine to meet specified objectives.

American Standards, American Standards Assn., 70 E. 45th St., New York 17, N. Y.:

Chromaticity of Fluorescent Lamps, Standard C78.376, 60¢. Developed to establish color values and tolerances for the 40-watt, T-12 fluorescent lamp to assure uniform color appearance.

Preferred Ratings for Power Circuit Breakers, C37.6-1959, 40¢. Represents standard practice in the U. S. for rating ac power circuit breakers. Tables are given for indoor and outdoor types, both oil and oilless. Included are voltage and current ratings, insulation level, and interrupting ratings.

Electrical Trade Book, Trade Service Publications, 117 E 37th St., New York, N. Y.

A condensed and illustrated cost book for electrical contractors, including a binder and index tabs covering the complete range of products used in electrical construction. Cost data is supplemented by information on comparative catalog numbers and cash discounts.

The Engineering Societies Directory, 1959 edition, \$3.50. Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

Provides a comprehensive listing of United States engineering and scientific societies, their functional staff personnel and publications. A nearly complete listing of Canadian engineering organizations is also included.

Successful Technical Writing, by Tyler G. Hicks. 287 pages; \$5.50. McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

Step-by-step guidance in all phases of technical, engineering and scientific writing—how to evaluate ideas, how to go about the writing job, building up an outline, how to work with editors and publishers. Valuable for technical personnel who have never written before as well as for established technical writers wishing to improve their skill.

1959 NATIONAL ELECTRICAL CODE

FROM PAGE 941

in such cases must "be protected in accordance with their current-carrying capacities." This is necessary to prevent excessive loading which will "cause an excessive or dangerous temperature in the conductor or conductor insulation" (section 240—2).

Wireways, Auxiliary Gutters for Outdoor Use

In the old code, wireways were permitted to be used "only for exposed work in dry locations." Auxiliary gutters were for use in "interior wiring systems." In the new code; both section 362—2 on wireways and section 374—1 on auxiliary gutters make outdoor applications permissible by stating that equipment for use outdoors "should be of approved raintight construction."

This change was made because of the availability of raintight wireways and gutters. However, the use of the words "should be" does not make clear whether this is a requirement or a recommendation.

Changes in Hazardous Location Wiring

Among changes in the articles on hazardous locations are the following:

(1) Type MI cable with termination fittings approved for the location may be used as a general wiring method in all classes and divisions of hazardous locations.

(2) Electrical metallic tubing



RICHARD GAITHER AND R. L. AMICK staff Moorehead Electric Company's branch office in Anderson, Ind. Dick is an estimator-engineer, while Bob's title is that of manager. Moorehead Electric's main office is located in Marion, Ind.



EVERETT MARSHALL, owner of Marshall Electric Co., San Mateo, Calif., was elected to the presidency of NECA's new San Mateo County Chapter.

is no longer permitted for use as a wiring method in Class 1, Division 2 locations because the necessary threaded fittings are no longer available. At least one manufacturer, however, has indicated an intention to produce suitable fittings

(3) Seals shall be located in Class 1, Division 1 locations— "In each conduit run of 2-in. size or larger entering an enclosure or fitting housing terminals, splices or taps, and within 18 ins. of such enclosure or fitting."

New High Voltage (Over 600) Rules

 Section 710—5 contains a table of voltage values for which shielding is required on rubber-insulated conductors under various conditions.

(2) Section 710—8 requires the use of a pothead or other approved techniques for protecting the insulation of a conductor where it emerges from a metal sheath and where protection from moisture or mechanical injury is necessary.

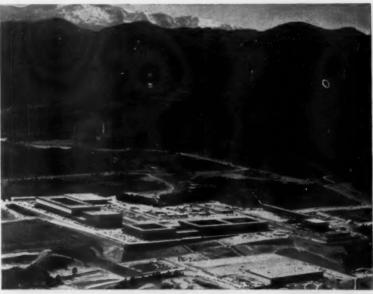
(3) Section 710—21 provides expanded coverage of overcurrent protective requirements for high voltage circuits.

(4) Section 710—21 sets forth specific provisions for circuit interrupting devices in high voltage application. Subdivision c of this section now adds the following on load interrupter switchgear:

"Load interrupter switches may be used providing suitable fuses or circuit breakers are used in conjunction with these devices to interrupt fault currents. When these devices are used in combination they shall be so coordinated electrically that they will safely withstand the effects of closing, carrying or interrupting all possible currents up to the assigned maximum short circuit rating."

IT TAKES A SPECIALIST LIKE STROMBERG-CARLSON

to engineer the most complete sound system



U. S. Air Force Academy, where a Stromberg-Carlson sound communication system is in use. Howard P. Foley Company, Electrical Contractors

In selecting a sound communication system by Stromberg-Carlson, the U.S. Air Force Academy was assured of the completeness required to meet its complex needs.

The sound installation is one of the largest in the country—almost 3,000 speakers. It is unique in that it can be used as an emergency system simply by indexing one switch. Many other unusual features are built in. Yet the entire system is composed of standard Stromberg-Carlson components!

This amazing flexibility is available to meet the needs of *your* customers. You can bid our equipment with complete confidence because:

 Installation help and supervision are available from our factory-trained

- sound distributors in all major
- Service and maintenance problems are negligible—as proved by thousands of installations now in use.
- Field sales engineers are at your service for consultation at any time.
- Our factory engineering staff is available to help solve complex installation problems.

When you bid Stromberg-Carlson, you bid competitively—with assurance of a good profit—and an installation that will add to your prestige.

For further details, or the name of our local representative, write — no obligation.

"There is nothing finer than a Stromberg-Carlson"

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MOUNTED on WHEELS and Ready to GO!



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- HANDIER THAN EVER

The Kalamobile has rubber-tired wheels and telescoping handles . can be shifted from job-to-job by one man with ease. This new Mobile Model M610D cuts pipe and conduit fast and clean. Capacity 6' rounds . . . 10" flats.

Machine Tool Division

Kalamazoo TANK and SILO CO.

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DATES AHEAD

International Association of Electrical Inspectors—Eastern Section, Essex and Sussex Hotel, Spring Lake, N. J., Sept. 14-17; Canadian Section, Queen Elizabeth Hotel, Montreal, Quebec, Canada, Sept. 25-26; Westrern Section, Schroeder Hotel, Milwaukee, Wis., Oct. 5-7; Southern Section, Heidelberg Hotel, Jackson, Miss., Oct. 12-14; Mississippi Chapter, Heidelberg Hotel, Jackson, Miss., Oct. 12-14.

Third Industrial Nuclear Technology Conference-Co-sponsored by Armour Research Foundation and NU-CLEONICS magazine, with the co-operation of the United States Atomic Energy Commission, Morrison Hotel, Chicago, Ill., September

Canadian Electrical Manufacturers Assn.—15th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., Canada, September 30-October 2.

Florida Association of Electrical Contractors-Annual convention and 7th Electrical Trade Show, Robert Meyer Hotel, Jacksonville, Fla., October

11th Biennial Electrical Industrial Exposition-Sponsored by Essex Electrical League; Armory, Elizabeth, N. J., October 10-12.

National Electronics Conference Sherman Hotel, Chicago, Ill., October 12-14.

Electrical Progress Show-Sponsored by Electrical Association of Philadelphia, Convention Hall, Philadelphia, Pa., October 13-15.

National Electrical Contractors Association-Annual convention and 5th National Electrical Exposition, Fontainbleau, Eden Roc, Deauville and Carillon Hotels, Miami Beach, Fla., November 9-12.

National Electrical Manufacturers Asan.—Annual meeting, Traymore Hotel, Atlantic City, N. J., Novem-

Industrial Electric Exposition-Sponsored by Electrical League of Western Pennsylvania, Penn-Sheraton Hotel, Pittsburgh, Pa., November Penn-Sheraton

American Institute of Electrical Engineers-Winter general meeting, New York, N. Y., January 31-February 5, 1960.

16th Annual National Wiring Sales Conference — Warwick Hotel, Philadelphia, Pa., February 25-26.

National Association of Electrical Distributors—Annual convention, Dallas, Texas, May 1-5.

National Industrial Service Assn., Inc. —Annual convention, Hotel Fontain-bleau, Miami Beach, Fla., May 4-7.

National Fire Protection Assn.-Annual meeting, Montreal, Canada, May 16-20.

Illuminating Engineering Society—National Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., September 11-16.



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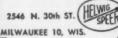
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CARBON BRUSHES

Protect your electrical tools with HELWIG BRUSHES. Equal in quality to original equipment. Stocked for immediate delivery. Write for catalog No. 97 and information on Special Tool Brush Kits and illustrated tool brush

AVAILABLE NOW "RED CARPET" RUSH BRUSH SERVICE.

CARBON PRODUCTS



FREE Samples

Among the Manufacturers

Headquarters Announcements

General Cable Corp. has relocated its office headquarters to 730 Third Ave., New York 17, N. Y.

Rockbestos Products Corp., New Haven, Conn., has been liquidated, its business now conducted as the Rockbestos Wire & Cable Co. Div. of Cerro de Pasco Corp.

Thomas Industries Inc., Louisville, Ky., has acquired C & M Products, Ltd., lighting fixture manufacturer of Toronto, Ontario, Canada.

Advance Transformer Co., Chicago, Ill., has joined Consolidated Electronics Industries Group.

Standard Wire & Cable Co., Los Angeles—Lawrence O. Seerden, general sales manager.

Mears Electric Circuit Breakers, Inc., Portland, Ore.—B. C. West, general sales manager.

Federal Pacific Electric Co., Newark, N. J.—Robert J. Wyllie, advertising and sales promotion manager.

Curtis-AllBrite Lighting, Inc., South San Francisco, Calif.—Robert H. Hirte, general sales manager for All-Brite Lighting Div.; Robert H. Shaffer, vice president in charge of manufacturing for the combined operations.

Clark Controller Co., Cleveland, Ohio—Victor M. Macha, manager; Edward J. Keegan, manager of divisional sales; both with American Electric Switch Div.

National Electric Div., H. K. Porter Co., Inc., Pittsburgh, Pa.—George F. Placier Jr., assistant sales manager; Raymond Huckestein, product manager, underfloor raceways; Walter H. Heer Jr., product manager, busways.

Wagner Electric Corp., St. Louis, Mo.—George W. Brown, president. Emerson Electric Mfg. Co., St.

Louis, Mo.—Richard Lindgren, manager of motor sales.

DuKane Corp., St. Charles, Ill.— Frederick R. Lack, director.

Chrysler Airtemp, Dayton, Ohio—E. Dale Dickson, manager, marketing—room air conditioners; Hugh Dillon, sales manager—room air conditioners.

Prescolite Mfg. Co., Berkeley, Calif.—F. L. Green, chief product design engineer.

Columbia Electric Co., Inc., Dallas, Tex.—Jerry Whitlow, general sales manager.

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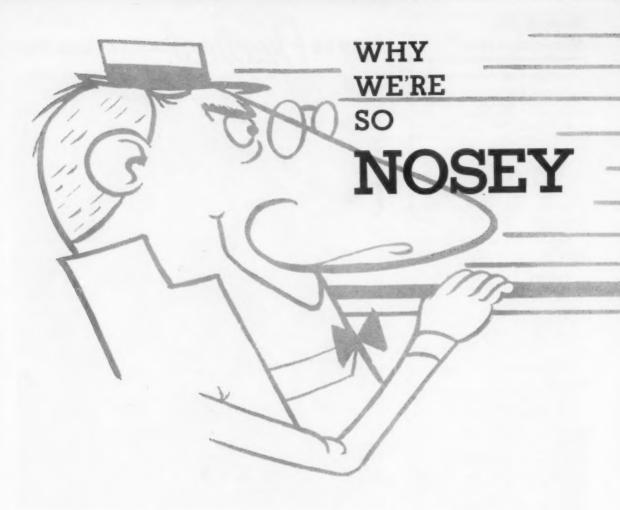
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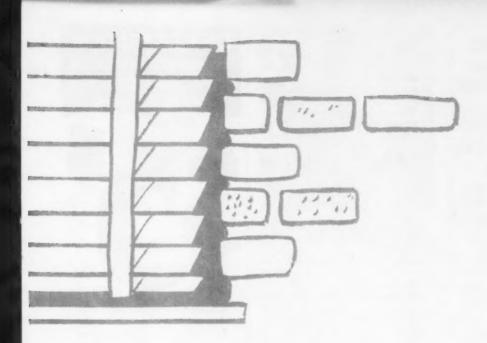
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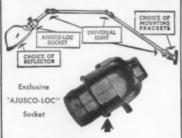
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Basic Products Corp., Milwaukee, Wis.—Harold E. Koch, executive vice president.

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Rawlplug Co., Inc., New Rochelle, N. Y.—Frederic B. Powers, Jr., secretary.

Rockbestos Wire & Cable Co., New Haven, Conn. — Elmer E. Barth, treasurer.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—William H. Davis, manager of electrical department, Norwood (Ohio) Works; N. W. Morelli, works manager, Pittsburgh plant; Charles R. Gibbs, director of service, Industries Group; Thomas J. Hanley, manager, service section, Industries Group.

Day-Brite Lighting, Inc., St. Louis, Mo.—O. C. Klingsick, vice president and controller; Robert A. Dennis, manager of Tupelo, Miss., plant.

M. H. Rhodes, Inc., Hartford, Conn.—C. P. Cairelli, chief engineer.

Regional Appointments

NEW ENGLAND

Ainsworth Lighting, Inc.: Dudley F. Collier, representative in eastern New England states.

Day-Brite Lighting, Inc.: Bernard J. Elfring, representative in Vermont, New Hampshire and Maine.

Allis-Chalmers Mfg. Co.: Hugh S. Sells, manager of Boston district.

General Electric Co.: Guy W. Fiske, manager of Construction Materials Div. Northeastern District.

Jefferson Electric Co.: Herbert P. Boyle, New England representative.

Sun-Tron Corp.: P. J. Heenan, representative in Canada.

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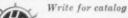


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Slater Electric & Mfg. Co., Inc.: Eberhardt Electric Sales Co., Buffalo, representative in state of New York except for Metropolitan New York area.

Thomas Industries Inc.: Jack Brown, sales representative of Moe Light products in Metropolitan New York area.

Moloney Electric Co.: L. R. Hurley, district manager of Narberth, Pa., office.

I-T-E Circuit Breaker Co.: John J. Sedlacek, manager, Philadelphia sales office.

Husky Products, Inc.: Rumsey Electric Co., Philadelphia, representative in eastern Pennsylvania, Delaware, Virginia, District of Columbia, Maryland, and New Jersey; Brown Electric Co., Pittsburgh, representative in western Pennsylvania and West Virginia.

United Transformer Corp.: Comtronic Associates, Mineola, N. Y., representative in Metropolitan New York area.

SOUTH ATLANTIC

Sun-Tron Corp.: Dean Griffith Co., Birmingham, representative in Mississippi, Alabama, and West Florida.

Husky Products, Inc.: New representatives: Charles W. Ashby Co., Birmingham, covering Alabama; George Weeks & Associates, Jacksonville, covering Florida; Osgood & Associates, Inc., Atlanta, covering Georgia; E. T. Green, Greensboro, covering North Carolina; Engineer Sales Co., Columbia, covering South Carolina.

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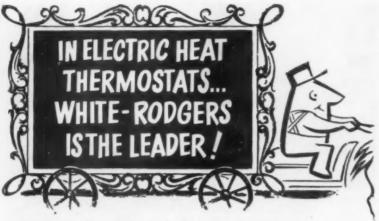
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Allis-Chalmers Mfg. Co.: Albert R. Knauss, district manager in Knoxville, Tenn.

John C. Virden Co.: Rudolph J. Takacs, sales representative in Cleveland, Ohio, territory for Virden Lighting Division.

Paine Company: Richard M. Ong, electrical sales representative in Louisiana and southern Mississippi.

WEST CENTRAL

Moloney Electric Co.: Robert T. Martin, assistant to the manager, Dallas, Texas, district office.

Sun-Tron Corp.: Geerdes & Geerdes, Wellsburg, Iowa, representative in Iowa, Nebraska, Minnesota and South Dakota.

Husky Products, Inc.: New representatives: Nelson Electric Supply Co., Tulsa, covering Oklahoma; Electrical Agencies of Dallas, covering northern Texas; Electrical Agencies of Houston, covering southern Texas.

National Supply Co.: Raymond B. Evers, sales representative of conduit and underfloor products, St. Louis, Mo.

Electro Lighting Corp.: Thomas J. Barr, San Antonio, district manager in south-central Texas.

WEST

Freed Transformer Co., Inc.: Nelson Co., Denver, representative in eastern Montana, Wyoming, Utah, South Dakota and Colorado; Conway Electronic Enterprises, representative in Toronto, Ontario, Canada.

Arro Expansion Bolt Co.: George P. Wilcox, Jr., Los Angeles, representative in southern California, Arizona and southern part of Nevada.

Sun-Tron Corp.: O. B. Wilt Co., San Carlos, Calif., representative in Washington, Oregon, California, western Nevada and Arizona.

Westinghouse Electric Corp.: Burton H. Piper, district manager of engineering and service for apparatus division in North Pacific area, office in Seattle.

Husky Products, Inc.: Marshall R. Elmore & Co., Carlsbad, representative in New Mexico.

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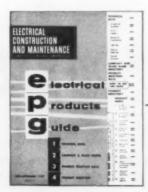
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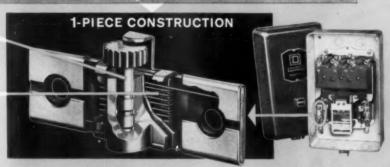
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